B+K PRECISION DYNASCAN CORPORATION

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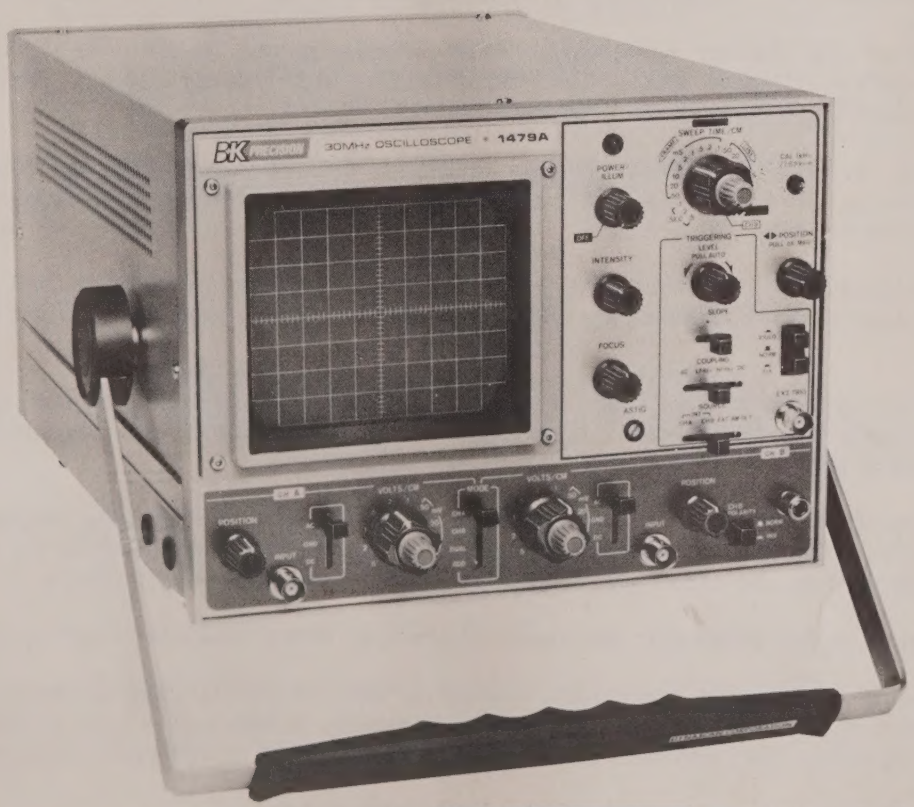
SERVICE MANUAL

for

Model 1474, 1479, 1479A, and 1479B

30 MHz Triggered Sweep

DUAL-TRACE OSCILLOSCOPE



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TEST INSTRUMENT SAFETY

WARNING

Normal use of test equipment and servicing of test equipment exposes you to a certain amount of danger from electrical shock because testing must often be performed where exposed high voltage is present. An electrical shock causing 10 milliamps of current to pass through the heart will stop most human heartbeats. Voltage as low as 35 volts dc or ac rms should be considered dangerous and hazardous since it can produce a lethal current under certain conditions. Higher voltage poses an even greater threat because such voltage can more easily produce a lethal current. Your normal work habits should include all accepted practices that will prevent contact with exposed high voltage, and that will steer current away from your heart in case of accidental contact with a high voltage. You will significantly reduce the risk factor if you know and observe the following safety precautions:

1. High voltage up to 6000 volts is present when servicing this oscilloscope. Observe all high voltage precautions when the unit is operating with the case removed. Remember that a high voltage charge may be retained indefinitely, especially at the CRT socket and anode cap. Discharge high voltage capacitors with a grounded test lead after removing power.

2. Don't expose high voltage needlessly. Remove housings and covers only when necessary. Turn off equipment while making test connections in high-voltage circuits. Discharge high-voltage capacitors after removing power.

3. If possible, familiarize yourself with the equipment being tested and the location of its high voltage points. However, remember that high voltage may appear at unexpected points in defective equipment.

4. Use an insulated floor material or a large, insulated floor mat to stand on, and an insulated work surface on which to place equipment; and make certain such surfaces are not damp or wet.

5. Use the time-proven "one hand in the pocket" technique while handling an instrument probe. Be particularly careful to avoid contacting a nearby metal object that could provide a good ground return path.

6. When using the oscilloscope, the ground wire of the 3-wire ac power plug places the chassis and housing of the oscilloscope at earth ground. Do not attempt to defeat the ground wire connection or float the oscilloscope; to do so may pose a great safety hazard.

7. When using a probe, touch only the insulated portion. Never touch the exposed tip portion.

8. When testing ac powered equipment, remember that ac line voltage is usually present on some power input circuits such as the on-off switch, fuses, power transformer, etc. any time the equipment is connected to an ac outlet, even if the equipment is turned off.

continued on inside back cover

SERVICE MANUAL
for
B & K-PRECISION

Models 1474,
1479, 1479A, and 1479B

DUAL-TRACE OSCILLOSCOPE

WARNING

This service manual is intended for use by qualified electronics technicians only. To avoid electric shock, do not perform servicing unless you are qualified to do so.

High voltages up to 6000 V dc are present when this instrument is operating. Line voltage (120 or 240 Vac) is present on the power input circuit whenever the ac power cord in connected to a live outlet, even if the scope is turned off. Observe all high voltage safety precautions when the housing is removed from the oscilloscope. Contacting exposed high voltage could result in fatal electric shock.

B+K PRECISION DYNASCAN CORPORATION

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Use this address for technical inquiries and replacement parts orders.

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Model 1474 Instuction Manual 480-187-9-001
Model 1479 Instruction Manual 480-264-9-001
Model 1479A Instruction Manual 480-280-9-001
Model 1479B Instruction Manual 480-302-9-001
Model 1474 Composite (Schematic Diagram and Parts List) 499-181-9-001
Model 1479 Composite (Schematic Diagram and Parts List) 499-161-9-001
Model 1479A Composite (Schematic Diagram and Parts List) 499-173-9-001
Model 1479B Composite (Schematic Diagram and Parts List) 499-202-9-001
LC-133 Carrying Case Instruction Sheet 481-123-9-001
RM-14 Rack Mounting Kit Instruction Sheet 481-088-9-001

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DIFFERENCES BETWEEN MODELS

SIMILARITIES

This manual covers the service and maintenance of **B & K-Precision** Models 1474, 1479, 1479A, and 1479B Triggered Sweep 30 MHz Oscilloscopes. All four models use the same basic circuit configuration and most of the service information applies equally to all models. The major features common to all four of these oscilloscopes are listed below.

30 MHz Bandwidth. High frequency input can be displayed with no distortion and high resolution.

11.7 ns Rise Time. The fast rise time allows for display of short duration pulses.

Dual Trace. Two waveforms can be displayed either singly or simultaneuosly. Chop or alternate method of dual trace automatically selected by sweep speed control.

Built in Delay Line. For viewing leading edges of high frequency, fast rise time pulses.

Triggered Sweep. Level control sets the point of triggering or sets an amplitude that must be met to obtain a sweep. In dual-sweep mode, either channel may be used as a sweep trigger.

Auto Sweep. Provides sweep when no trigger signal is applied. Automatically reverts to triggered sweep when a signal is applied.

Versatile Triggering. Choice of CH A, CH B, or external trigger source. Selectable trigger coupling offers choice of ac, dc, or ac with high or low frequency rejection.

FIX Mode. A selectable FIX mode sets triggering at middle of waveform regardless of LEVEL control.

High Sensitivity. 5 mV/div sensitivity permits the use of low-capacitance, high-impedance probes.

Sum and Difference Capability. Input from both channels may be algebraically added or subtracted for differential voltage measurements.

Calibration Source. A 0.5 V, 1 kHz square wave is provided to aid in scope checking and probe compensation.

20 Sweep Speeds. Allows for calibrated time measurements from 0.2 µs/div to 0.5 s/div.

Expanded Scale. The trace display can be magnified five times for greater visual accuracy.

X-Y Operation. Channel B input can be used as the horizontal deflection (X axis) and Channel A as vertical deflection (Y axis).

Z-Axis Input. Intensity modulation permits time or frequency marking from a TTL source.

DIFFERENCES

Unless otherwise noted, all information in this manual applies equally to Model 1474, 1479, 1479A, and 1479B. The schematics of the individual circuit boards and the accompanying circuit board maps are the latest version available at the time of printing, but can generally be used for troubleshooting and servicing of all four models. A separate overall schematic of each model is provided for convenience.

B & K-Precision continually strives to improve its products. Changes of a significant

nature, such as adding a function, are identified by changing the model designation. Thus, the model designations represent the chronological improvements upon the original design. The Model 1474 was the original 30 MHz oscilloscope based upon this design. It was followed by Model 1479, which had considerable difference in mechanical appearance, and AM DETect triggering was added. When the video sync separator was added, the model designation was changed to 1479A. Most recently, with the change from a round to a rectangular CRT, the model designation became 1479B.

More specific details of the differences between models are given below. Complete part by part differences are itemized in the parts list.

Model 1474 is recognized by: a black front panel, a tan case, a flat handle, a detachable power cord, and an external 100/120/220/240 line voltage plug. Triggering selection is either CH A, CH B, EXT (unattenuated) or EXT 1/10 (10:1 attenuation).

Model 1479 has several changes in appearance from its forerunner, Model 1474. The 1479 has a grey and silver front panel, a biege case, and a formed handle. Electrical changes were also made to trigger and sweep circuits. The EXT 1/10 trigger source selection was replaced by AM DET to allow for triggering on the modulation envelope of an AM signal. Adjustments were added on the sweep board for high speed sweep linearity. While the initial production lots of 1479's still have the detachable power cord and external line voltage selector plug (like the 1474), the later units have a fixed power cord and internal 120/240 line voltage plug.

Model 1479A incorporated a selectable video sync separator circuit. The VIDEO selection permits triggering on the sync pulses from a composite video signal. Vertical sync pulses (frame) are automatically selected for triggering at slower sweep times of 0.5 s/div to 0.1 ms/div. Such sweep times are appropriate for viewing vertical frames of video. Horizontal sync pulses (line) are automatically selected for triggering at faster sweep times of 50 µs/div to 0.2 µs/div (appropriate for viewing horizontal lines of video). The front panel is changed to allow for the added VIDEO/ NORM switch. The previous AUTO LEVEL/ NORM switch is relabeled FIX/ NORM, but the function remains the same.

Model 1479B incorporates a rectangular CRT with internal etched graticule (non-illuminated) to replace the previous round CRT with illuminated graticule. The power supply is changed to use a -1.5 kV CRT cathode voltage and a voltage tripler developing +4.5 kV for the CRT anode. This compares with a -1.9 kV cathode potential and voltage doubler (+3.8 kV) for anode potential in previous models. Electrical trace rotation (adjustable from the front panel) was also added. This includes a rotation coil on the neck of the CRT and a corresponding trace rotation circuit on the power supply board.

PRODUCTION CHANGES

Our program of continuous evaluation and product improvement may often involve minor changes and refinements which are not significant enough to change the model designation. Beginning with Model 1479A and continuing with Model 1479B (unfortunately, we have no similar information for Model 1474 or 1479), we have compiled a list of all such production changes, along with the serial numbers where such changes became effective. This information is located at the very end of this manual in the HISTORY OF PRODUCTION CHANGES section.

This information should be helpful when the unit you are servicing does not exactly match the schematic diagram or parts list found in this service manual. Because production changes often require several compatible parts, working in conjuction with each other to achieve the improvement, replacement parts should usually restore the unit to its original configuration.

SPECIFICATIONS

Unless otherwise stated, all specifications apply equally to Model 1474, 1479, 1479A, 1479B.

VERTICAL AMPLIFIERS (CH A and CH B)

Deflection Factor
5 mV/div to 5 V/div, ±3%, in 10 ranges, each with fine adjustment.

Frequency Response
DC: DC to 30 MHz (-3 dB).
AC: 10 Hz to 30 MHz (-3 dB).

Risetime
11.7 nanoseconds or less.

Overshoot
3% or less.

Input Impedance
1 megohm, ±2%, shunted by 23 pF (±3 pF).

Tilt
Less than 5%.

Max. Input Voltage
300 VDC + AC peak or 600 V p-p.

Operating Modes
Channel A only.
Channel B only.
Dual trace: automatically chopped at all sweep times of 1 ms/div and slower; alternate trace automatically selected for all faster sweep times.
Add: single-trace algebraic sum of Channels A and B (difference using CH B INVert).

Chop Frequency
200 kHz (±20%).

Channel Separation
Better than 70 dB @ 1 kHz.

Signal Delay
Fixed, 12 ns minimum visible delay.

CH B Polarity
Normal, inverted (provides CH A minus CH B function).

Maximum Undistorted Amplitude
Model 1479A and 1479B: More than 8 div from dc to 30 MHz.
Model 1474 and 1479: More than 8 div from dc to 10 MHz. More than 4 div to 30 MHz.

HORIZONTAL AMPLIFIER (Horizontal input thru CH B input)

X-Y Operation
With SWEEP TIME/DIV switch in CH B position, the CH A input becomes the Y axis input (vertical) and the CH B input becomes the X axis input (horizontal). The CH B position control becomes the horizontal position control.

Deflection Factor
5 mV/div to 5 V/div, ±3%, in 10 ranges, each with fine adjustment.

Frequency Response
DC: DC to 2 MHz (-3 dB).
AC: 10 Hz to 2 MHz (-3 dB).

Input Impedance
1 megohm ±2%, shunted by 22 pF (±3 pF).

Input Protection
300 VDC + AC peak or 600 p-p.

SWEEP CIRCUITS
(Common to CH A and CH B)

Sweep System
Triggered and automatic.

Sweep Time
0.2 µs/div to 0.5 s/div (±3%), in 20 ranges, in 1-2-5 sequence with vernier adjustment.

Sweep Magnification
X5 (five times) ±5%. Extends maximum sweep rate to 40 ns/div.

Linearity
3% or better, 5% or better with X5 magnification.

TRIGGERING

Source
Model 1474: CH A, CH B, EXT, and EXT 1/10.
Model 1479, 1479A, and 1479B: CH A, CH B, EXT and AM DET.

Automatic
Sweep is triggered without input signal.

Normal
Sweep is obtained with a displayed signal amplitude of one division or less. The point on the displayed waveform at which the sweep starts is determined by the SLOPE and LEVEL controls.

Slope
Sweep can be set to trigger on the positive or negative going slope of the trigger waveform.

Level
Continuously variable. Pull for AUTO (Sweep is obtained without an input signal).

FIX
Automatically fixes triggering level at center of trigger signal.

AM DET (Models 1479, 1479A and 1479B)
Triggers from modulation envelope of amplitude modulated signal (carrier frequency 3 MHz or greater).

Coupling

AC:	20 Hz to 30 MHz
DC:	DC to 30 MHz.
LF REJ:	Attenuate below 10 kHz.
HF REJ:	Attenuate above 30 kHz.

Video (Model 1479A and 1479B only)
Vertical and horizontal sync separator circuit provided so that any portion of composite video waveform can be synchronized and expanded for viewing. LINE sync (horizontal sync pulses) automatically selected at sweep times of .2 µs/div. to 0.5 µs/div. and FRAME sync (vertical sync pulses) automatically selected at sweep times of .1 ms/div. to .5 s/div.

TRIGGER SENSITIVITY

		Minimum Sync Voltage	
Coupling	Bandwidth	INT	EXT
AC	20Hz - 15MHz	0.3 Div.	0.1 V pp
	10Hz - 30MHz	1 Div.	0.5 V pp
LF REJ	20kHz - 15MHz	0.3 Div.	0.1 V pp
	10kHz - 30MHz	1 Div.	0.5 V pp
HF REJ	20Hz - 50kHz	0.3 Div.	0.1 V pp
	10Hz - 300kHz	1 Div.	0.5 V pp
NORM DC	DC - 15MHz	0.3 Div.	0.1 V pp
	DC - 30MHz	1 Div.	0.5 V pp
FIX	20Hz - 15MHz	0.3 Div.	0.1 V pp
	10Hz - 20MHz	1 Div.	0.5 V pp

Z AXIS INPUT (Intensity Modulation)

Sensitivity
5 V (TTL compatible).

Usable Frequency Range
DC to 5 MHz.

Input Impedance
10 kΩ.

Maximum Input Voltage
50 V DC + AC peak.

OTHER SPECIFICATIONS

Operating Environment
0° to + 45° C.

Power Requirements
117/234 VAC, 50/60 Hz, 25 watts. Calibration will remain constant over 105 to 130 VAC input.

Calibration
Internal 0.5 V p-p ±1% (square wave at 1 kHz ±3%).

OVERALL DIMENSIONS (Fig. 1)
295 x 202 x 437 cm.

Maximum (WxHxD)
(11-5/8 x 7-15/16 x 17-13/16")

Weight
8.5 kg; 19 lb.

CRT

Models 1474, 1479, and 1479A
5" Round CRT with P31 phosphor. Post deflection acceleration. Approx. 4 kV acceleration. 8 x 10 division graticule scale (1 division = 1 cm), variable illumination. Mechanical trace rotation. See H9155A-P31 CRT specifications for more detail.

Model 1479B
140 mm rectangular CRT. Internal 8 x 10 division graticule scale (1 division = .9 cm). Post deflection acceleration. Approx. 6 kV acceleration. Electrical trace rotation, adjustable from front panel. See 140CGB31 CRT specifications for more detail.

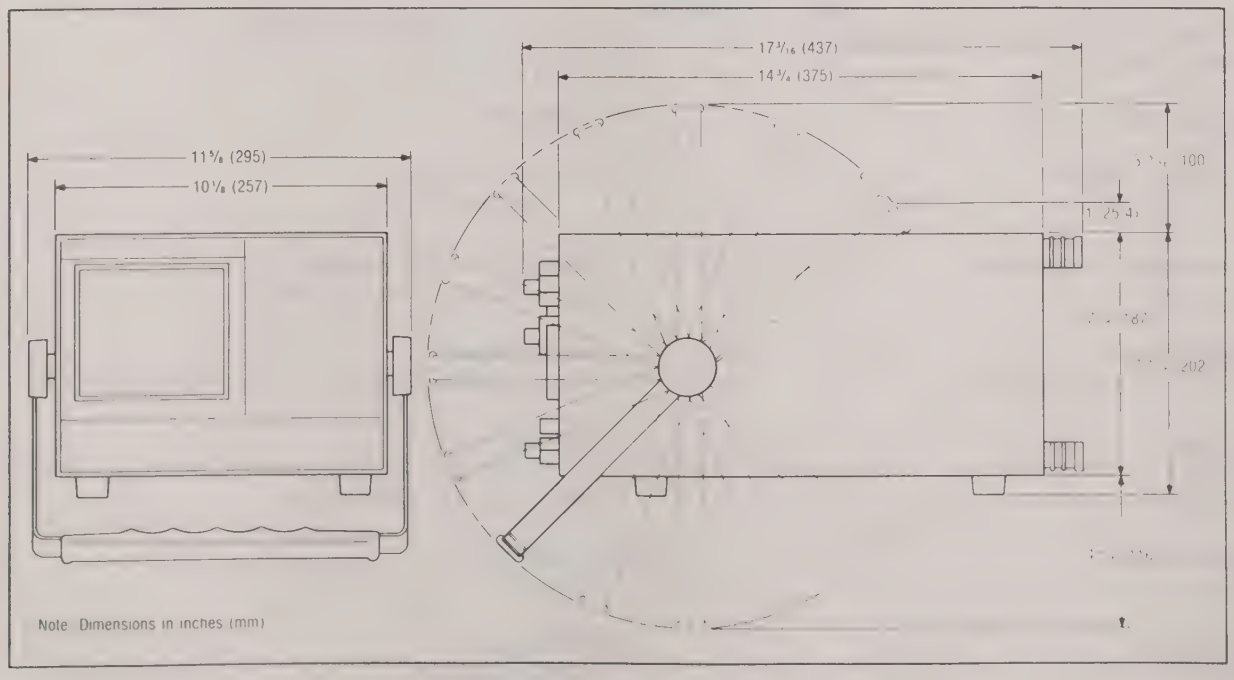


Fig. 1. Overall Dimensions.

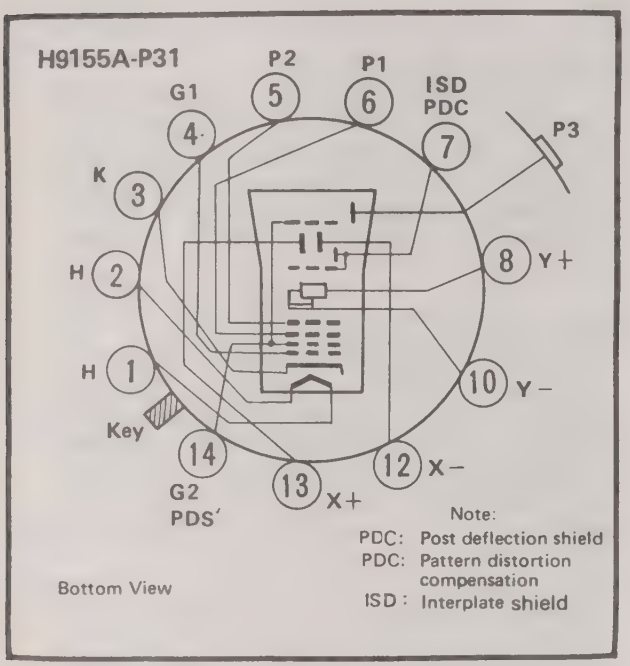


Fig. 2. H9155A-P31 Basing Diagram.

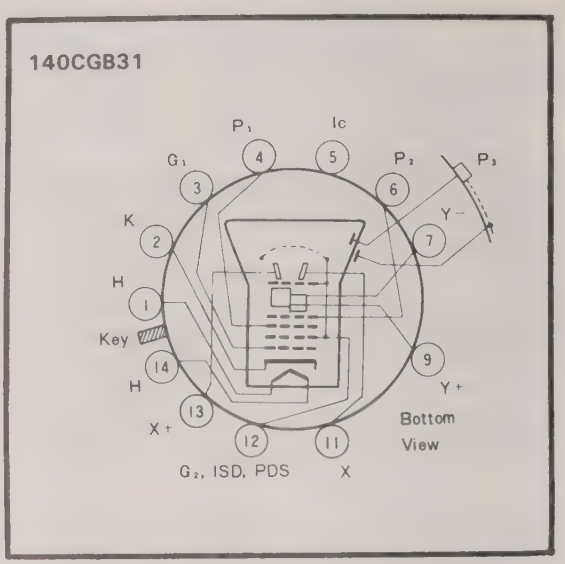


Fig. 3. 140CGB31 Basing Diagram.

H9155A-P31 CRT Specifications
(refer to Fig. 2)

Dimensions

Overall Length
355mm.

Face plate dimension:
133±1.8 mm.

Screen Shape
Round and Flat Face.

Focusing
Electrostatic deflection and focusing. Post deflection acceleration.

Flourescence
Green.

Persistence
Medium short.

Display Area
110 x 90 mm^2.

140CGB31 CRT Specifications
(refer to Fig. 3)

Dimensions

Overall Length
310 mm or less.

Face Plate Dimensions
143.5±1.5 mm maximum.

Screen Shape
Rectangular, flat face, internal graticule.

Focusing
Electrostatic deflection and focusing. Post deflection acceleration.

Flourescence
Green.

Persistence
Medium short.

Display Area
95.0 x 76.0 mm^2.

H9155A-P31 CRT Specifications
(continued)

Heater voltage
6.3 V ±10%.

Heater current
0.095 A ±10%.

2nd Plate voltage
1400 V.

Capacitance

G1 to all other element:
7.5 pF.

K to all other element:
4.0 pF.

140CGB31 CRT Specifications
(continued)

Heater Voltage
6.3 V

Heater Current
0.24 A.

3rd Plate Voltage
6.3 V maximum.

2nd Plate Voltage
1800 V maximum.

2nd Grid Voltage
1700 V maximum.

1st Grid Voltage
200 V maximum.

Cathode to Heater Voltage
125 V maximum.

Voltage Between 2nd Plate and Any Deflection Plate
500 V maximum.

ACCESSORIES

ACCESSORIES SUPPLIED

Two 10:1/Direct Probes.
Instruction Manual.
Composite (Schematic Diagram & Parts List).
Spare Fuse.

OPTIONAL ACCESSORIES

LC-74 Protective Cover.
LC-133 Carrying Case.
RM-14 Rack Mounting Kit.
PR-37 DeLuxe 10:1/Direct Probes.

MODEL LC-74 PROTECTIVE COVER

This rugged grained leatherette cover covers the front panel and provides lightweight, convenient protection while transporting the oscilloscope. A handy pocket provides stowage for probes.

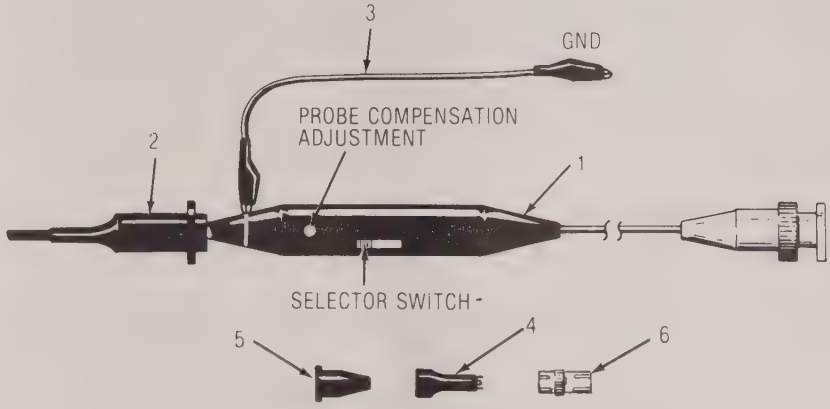
MODEL LC-133 CARRYING CASE

A carrying case that completely encloses the oscilloscope, providing superior protection while transporting the unit. A probe stowage pocket is provided.

MODEL RM-14 RACK MOUNTING KIT

This kit includes the panel hardware and instructions needed to mount the oscilloscope in a standard 19 inch rack.

PR-40 10:1/DIRECT PROBE



PR-40 10:1/Direct Probe.

ITEM	DESCRIPTION	PART NO.
	Complete PR-40 Probe with accessory tips	535-040-0-000
1	Probe & Cable Assembly	523-324-9-001
2	Spring Hook Assembly	523-316-9-001
3	Ground Wire Assembly	523-325-9-001
4	IC Tip	380-378-9-001
5	Insulating Tip	380-378-9-002
6	BNC Adapter	768-016-9-001
	Red Adhesive Strip	485-018-9-001
	Gray Adhesive Strip	485-018-9-002
	Instruction Sheet	481-121-9-001

SPECIFICATIONS

	10X position	1X position
Attenuation	10:1 ±1% (at oscilloscope input impedance of 1 MΩ ±1%)	-
Input Impedance	10 MΩ ±1%	1 MΩ ±1%
Input Capacitance	less than 18 pF	less than 100 pF
Bandwidth	100 MHz	15 MHz
Rise Time	3.5 ns	24 ns
Compensation Range	15 to 40 pF	
Maximum Input Voltage	500 V p-p; 250 V dc + ac peak	

DESCRIPTION

The B & K-Precision Model PR-40 deluxe probe is designed for use with wideband oscilloscopes to 100 MHz. The PR-40 is a slim-body probe of precision lightweight construction. A three position switch selects 10:1 or direct modes, or a reference position that grounds the tip through a 9 megohm resistor.

Accessories included with the PR-40 are a spring-loaded retractable tip cover, insulating tip, BNC tip adapter, and IC tip. The insulating tip is designed for probing dense solid-state circuitry with little danger of shorting nearby components. The BNC adapter tip converts the probe tip into a push-on BNC fitting, ideal for interface with test points or output jacks. The IC tip guides the probe contact into any pin of a standard DIP, making it almost impossible to short two pins of an IC.

The PR-40 is supplied with both grey and red adhesive strips, which are particularly useful with a dual-trace scope for instant identification of the channel to which a probe is connected. The PR-40 and accessories come in a convenient vinyl case.

OPERATION

By setting the selector switch of the probe to the "1X" position, an unattenuated waveform can be observed. Note that bandwidth is 15 MHz in this position.

By setting the switch to the "10X" position, the probe input impedance is increased to 10 megohms and the waveform being observed is attenuated 10:1. The "10X" position must be used above 15 MHz and whenever the loading effect of the probe may disturb normal operation of a circuit. Signal attenuation is 10:1 when using the standard 1 megohm input impedance (use coaxial cable rather than the probe when terminated into 50 ohms). This high impedance probe will cause very little error in measurements in circuits of 1 megohm impedance or less.

The "REF" positon of the probe selector switch opens the probe input and grounds the oscilloscope input, allowing convenient measurement of reference level.

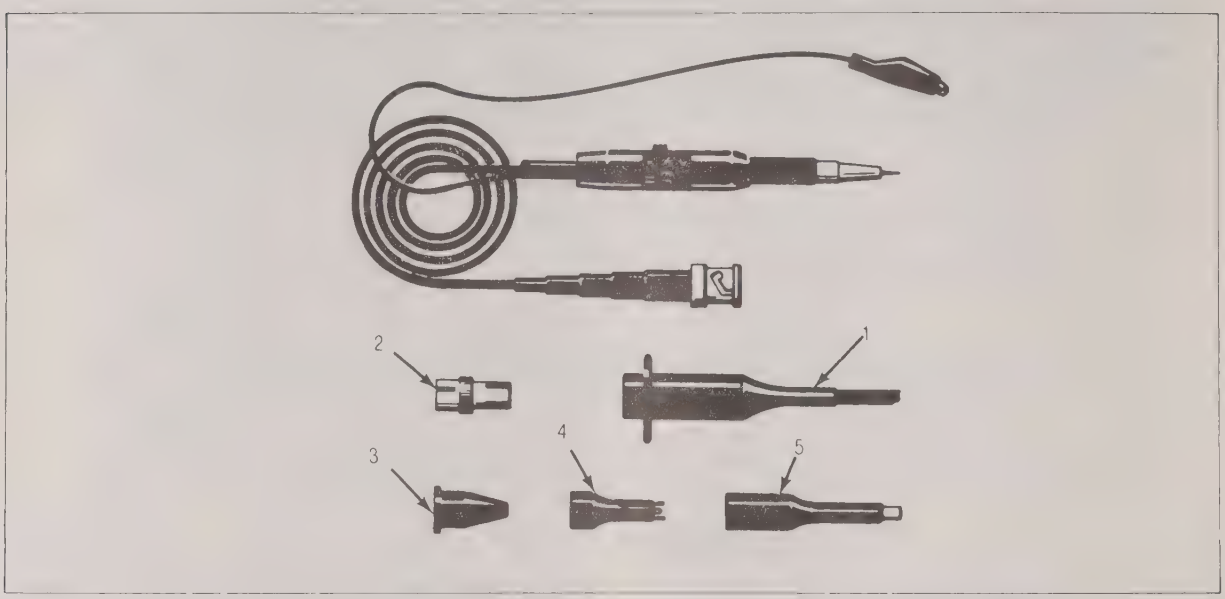
ADJUSTMENT

Set the probe selector switch to the "10X" position. Connect probe to vertical input of oscilloscope. Use the oscilloscope's most sensitive vertical attenuator setting and, while observing a 1 kHz or 10 kHz square wave signal, adjust the trimmer on the probe with an insulated screwdriver for best square wave presentation; that is, least overshoot, tilt, and rounding off of square wave.

SERVICING

The probe is not repairable. This includes both repairs to the main probe assembly and replacement of the special type coaxial cable. The impedance, capacitance, and bandwidth characteristics of the probe are very critical, and can only be assured by assembly at the factory. Servicing consists of probe compensation adjustment and replacement of those items listed in the parts list.

PR-37 DELUXE 10:1/DIRECT PROBE



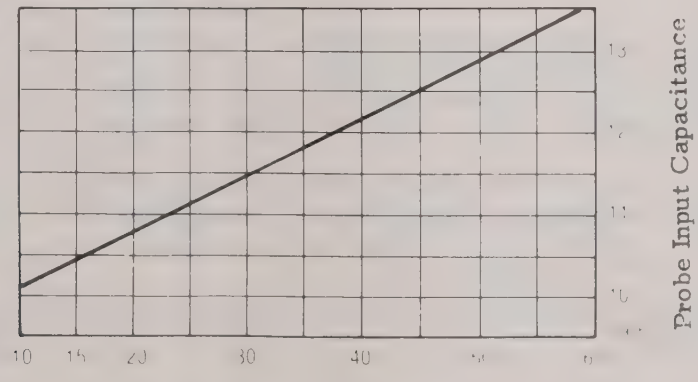
PR-37 Deluxe 10:1/Direct Probe.

ITEM	DESCRIPTION	PART NO.
	Complete Dual PR-37 Probe Set with accesory tips, 1 Gray and 1 Red	534-096-0-000
	Complete PR-37(G) Probe with accessory tips, Gray	534-097-0-000
	Complete PR-37(R) Probe with accessory tips, Red	534-098-0-000
1	Spring Hook Assembly, Gray	521-090-9-001
1	Spring Hook Assembly, Red	521-091-9-001
2	BNC Adapter	521-089-9-004
3	Insulating Tip	521-089-9-001
4	IC Tip	521-089-9-005
5	Trimmer Tool	521-089-9-003

SPECIFICATIONS

	10X position	1X position
Bandwidth	dc to 100 MHz	dc to 10 MHz
Rise Time	3.5 ns	35 ns
Input Impedance	10 MΩ ±1% (when used with oscilloscopes with a 1 MΩ input)	1 MΩ (oscilloscope input)
Input Capacitance	11.5 pF (when used with oscilloscopes which have 30 pF input capacitance) *	40 pF (plus oscilloscope capacitance)
Compensation Range	10 to 60 pF	
Maximum Input Voltage	600 volts p-p or dc + ac peak	
REF Positon	probe grounded via 9 MΩ resistor, oscilloscope input grounded	
Connector	BNC	
Length	approx. 60"	

* = for other values see graph.



Oscilloscope Input Capacitance

DESCRIPTION

The B&K-PRECISION Model PR-37 deluxe probe is designed for use with wideband oscilloscopes to 100 MHz. The PR-37 is a slim-body probe of precision lightweight construction. A three position switch selects 10:1 or direct modes, or a reference position that grounds the tip through a 9-megohm resistor. The 52" coaxial cable is extremely flexible.

Accessories included with the PR-37 are a spring-loaded retractable tip cover, insulating tip BNC tip adapter, IC tip and an insulated compensation capacitor adjustment tool. The insulating tip is designed for probing dense solid-state circuitry with little danger of shorting nearby components. The BNC adapter tip converts the probe tip into a push-on BNC fitting, ideal for interface with test points or output jacks. The IC tip guides the probe contact into any pin of a standard DIP, making it almost impossible to short two pins of an IC.

The PR-37 is available in both grey and red colors. Probes of different colors are particularly useful with a dual-trace scope for instant identification of the channel to which a probe is connected. The PR-37 and accessories come in convenient zippered vinyl case. Model PR-37G is grey and PR-37R is red.

OPERATION

By setting the selector switch of the probe to the "1X" position, an unattenuated waveform can be observed. Note that bandwidth is 10 MHz in this position.

By setting the switch to the "10X" position, the probe input impedance is increased to 10 megohms and the waveform being observed is attenuated 10:1. The "10X" position must be used above 10 MHz and whenever the loading effect of the probe may disturb normal operation of a circuit. Signal attenuation is 10:1 when using the standard 1 megohm input impedance (use coaxial cable rather than the probe when terminated into 50 ohms). This high impedance probe will cause very little error in measurements in circuits of 1 megohm impedance or less.

The "REF" positon of the probe selector switch opens the probe input and grounds the oscilloscope input, allowing convenient display of reference level.

ADJUSTMENT

Set the probe selector switch to the "10X" position. Connect probe to vertical input of oscilloscope. Use the oscilloscope's most sensitive vertical attenuator setting and, while observing a 1 kHz or 10 kHz square wave signal, adjust the trimmer on the probe with an insulated screwdriver for best square wave presentation; that is, least overshoot, tilt, and rounding off of square wave.

SERVICING

The probe is not repairable. This includes both repairs to the main probe assembly and replacement of the special type coaxial cable. The impedance, capacitance, and bandwidth characteristics of the probe are very critical, and can only be assured by assembly at the factory. Servicing consists of probe compensation adjustment and replacement of those items listed in the parts list.

CONTROLS & INDICATORS
(Refer to Fig. 4)

Unless otherwise stated, all information in this section applies equally to Models 1474, 1479, 1479A, and 1479B.

GENERAL CONTROLS (1-13)

1. **MODE Switch.** Four-position lever switch; selects the basic operating modes of the oscilloscope.

   CH A Only the input signal to Channel A is displayed as a single trace.

   CH B Only the input signal to Channel B is displayed as a single trace.

   DUAL Dual-trace operation; both the Channel A and Channel B input signals are displayed on two separate traces.

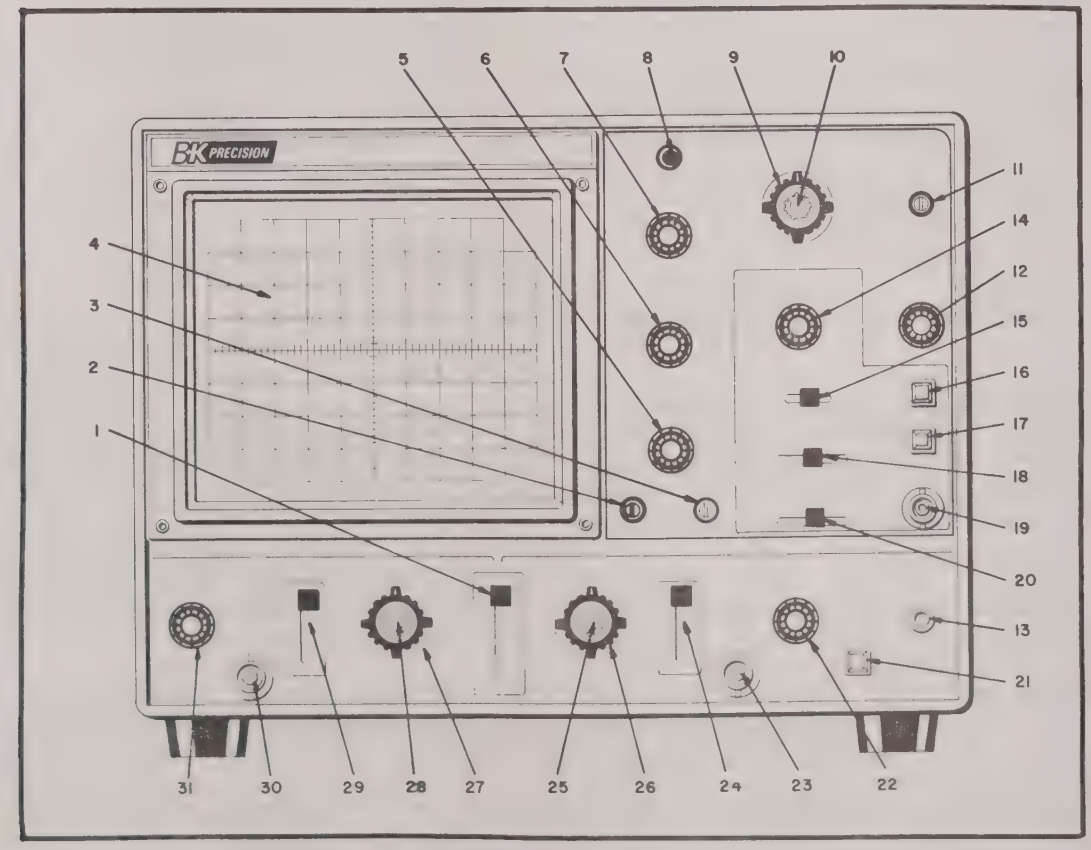


Fig. 4. Front Panel Controls and Indicators.

ADD The waveforms from Channel A and Channel B inputs are added and the sum is displayed as a single trace. When the CH B POLARITY button is in INV, the waveform from Channel B is subtracted from the Channel A waveform and the difference is displayed as a single trace.

2. **TRACE ROTATION Control** (Model 1479B only). Electrical trace rotation adjustment for rectangular CRT.

3. **ASTIGmatism Adjustment.** Adjustment provides optimum spot roundness when used in conjunction with FOCUS and INTENSITY controls. Very little readjustment of this control is required after initial adjustment.

4. **Cathode Ray Tube (CRT).** This is the screen on which the waveforms are viewed. Model 1479B has a rectangular CRT with an internal 8 x 10 division graticule scale, which reduces parallax error to minimum. Models 1474, 1479, and 1479A use a round CRT with an external 8 x 10 division graticule scale with variable illumination.

5. **FOCUS Control.**

6. **INTENSITY Control.** Adjusts brightness of trace.

7. **POWER On-Off Control.** Fully counterclockwise rotation turns off oscilloscope; clockwise rotation turns on oscilloscope. On Models 1474, 1479 and 1479A, further clockwise rotation increases illumination of the graticule scale.

8. **Pilot Light.** Glows when oscilloscope is turned on.

9. **SWEEP TIME/DIV Switch.** Horizontal coarse sweep time selector. Selects calibrated sweep times of 0.2 μs/div (microsecond per division) to 0.5 s/div in 20 steps when VARIABLE control is set to the CAL position (fully clockwise). In the CH B position, this switch disables the internal sweep generator and permits the CH B input to provide horizontal deflection (X-Y operation). The Channel A input signal produces vertical deflection (Y axis) and the Channel B input signal produces horizontal deflection (X axis).

10. **Sweep Time VARIABLE Control.** Fine sweep time adjustment. In the extreme clockwise (CAL) position the sweep time is calibrated.

11. **CAL 1 KHz ⎍⎍ 0.5 V p-p Terminal.** Provides calibrated 1 KHz, 0.5 volt peak-to-peak square wave input signal. This is used to check the frequency compensation adjustment of the probes used with the oscilloscope and for a general check of calibration.

12. **◀ ▶ POSITION Control.** Rotation adjusts horizontal position of traces (both traces when operated in the dual trace mode). Push-pull switch selects 5 X magnification when pulled out (PULL 5X MAG); normal when pushed in.

13. **⏚ Terminal/Binding Post.** Earth and chassis ground.

TRIGGERING CONTROLS (14–17)

14. **LEVEL Control.** Sync level adjustment determines points on waveform slope where sweep starts; (-) direction equals more negative point of triggering and (+) direction equals more positive point of triggering. Push-pull switch selects automatic triggering when pulled out (PULL AUTO). When automatic triggering, a sweep is generated even without an input signal (free runs), but resumes triggered sweep operation when a trigger signal is present.

15. **SLOPE Switch.** Two-position lever switch with the following positions:

(+) Sweep is triggered on positive-going slope of waveform.

(-) Sweep is triggered on negative-going slope of waveform.

16. **VIDEO Switch** (Models 1479A and 1479B only). Pushbutton switch selects NORM triggering with button out, VIDEO triggering with button in. In VIDEO position, sync pulses of a composite video signal are used to trigger the sweep; vertical sync pulses (frame) are automatically selected for sweep times of 0.5 s/div to 0.1 ms/div and horizontal sync pulses (line) are automatically selected for sweep times of 50 µs/div to .2 µs/div.

17. **FIX Switch.** Pushbutton switch selects NORM triggering level with button out, FIX level with button in. In FIX position, trigger level is automatically fixed at center of trigger signal regardless of setting of LEVEL control.

18. **COUPLING Switch.** Four-position lever switch with the following positions:

AC	Trigger is AC-coupled, 20 Hz to 30 MHz response.
LF REJ	Triggering below 10 kHz is attenuated.
HF REJ	Triggering above 30 kHz is attenuated.
DC	Trigger is DC-coupled.

19. **EXT TRIG Jack.** Input terminal for external trigger signal.

20. **SOURCE Switch** Four-position lever switch selects triggering source for sweep.

INT CH A position.
In DUAL or ADD mode, sweep is triggered by signal applied to Channel A INPUT jack.

INT CH B position.
In DUAL or ADD mode, sweep is triggered by signal applied to Channel B INPUT jack.

In CH A mode, sweep is triggered by signal applied to Channel A INPUT jack when SOURCE switch is in either INT position.

In CH B mode, sweep is triggered by signal applied to Channel B INPUT jack when SOURCE switch is in either INT position.

EXT position. Sweep is triggered by signal applied to EXT TRIG jack.

EXT 1/10 position (Model 1474 only). Sweep is triggered by signal applied to EXT TRIG jack; signal is attenuated 10:1.

AM DET position (Models 1479, 1479A and 1479B). Sweep is triggered by modulation envelope rather than carrier signal, for amplitude modulated carrier signal of 3 MHz or greater. In DUAL or ADD mode, trigger is derived from Channel A signal.

CHANNEL B CONTROLS (21-26)

21. **CH B POLARITY Pushbutton Switch.** In the NORM position (button out), the Channel B signal is non-inverted. In the INV position (button in), the Channel B signal is inverted. When MODE switch is in the ADD position and this switch is in the INV position, the Channel B signal is subtracted from the Channel A signal and the difference is displayed as a single trace.

22. **POSITION Control.** Vertical position adjustment for Channel B trace. Becomes horizontal position adjustment when SWEEP TIME/DIV switch is in the CH B position (X-Y operation).

23. **INPUT Jack.** Vertical input jack of Channel B. Jack becomes external horizontal input when SWEEP TIME/DIV switch is in the CH B position (X-Y operation.)

24. **Channel B AC-GND-DC Switch.**

AC	Blocks dc component of input signal.
GND	Opens signal path and grounds input to vertical amplifier. This

provides a zero-signal base line, the position of which can be used as a reference when performing dc measurements.

DC Direct input of ac and dc component of input signal.

25. **VOLTS/DIV Switch.** Vertical attentuator for Channel B which provides step adjustment of vertical sensitivity. Vertical sensitivity is calibrated in 10 steps from 5 mV to 5 volts per division when VARIABLE control is set to CAL position. This control adjusts horizontal sensitivity when the SWEEP TIME/DIV switch is in the CH B position (X-Y operation.)

26. **VARIABLE Control.** Vertical gain adjustment provides fine control of vertical sensitivity. In the extreme clockwise (CAL) position, the vertical attenuator is calibrated. This control becomes the fine horizontal gain control when the SWEEP TIME/DIV switch is in the CH B position.

CHANNEL A CONTROLS (27-31)

27. **VOLTS/DIV Switch.** Vertical attenuator for Channel A which provides coarse adjustment of vertical sensitivity. Vertical sensitivity is calibrated in 10 steps from 5 mV to 5 volts per division when VARIABLE control is set to the CAL position.

28. **VARIABLE Control.** Vertical gain adjustment provides fine control of vertical sensitivity. In the extreme clockwise (CAL) position, the vertical attenuator is calibrated.

29. **Channel A AC-GND-DC Switch.**

AC Blocks dc component of input signal.

GND Opens signal path and ground input to vertical amplifier. This provides a zero-signal base line, the position of which can be used as a reference when performing dc measurement.

DC Direct input of ac and dc component of input signal.

30. **INPUT Jack.** Vertical input jack of Channel A.

31. **POSITION Control.** Vertical position adjustment for Channel A trace.

ADDITIONAL FACILITIES (See Fig. 5)

32. **Carrying Handle/Tilt Stand.** Push in both pivot points to unlock and rotate handle. Will lock at each 22.5° angle of rotation.

33. VR106. **CH B DC BAL Control** (under rubber button). Vertical dc balance adjustment for Channel B trace.

34. VR108. **CH B ATTEN BAL Control** (under rubber button). Step attenuator balance adjustment for Channel B trace.

35. **AC Power Cord.**

36. **Fuse Holder.**

37. **Z AXIS INPUT Jack.** Intensity modulation input.

38. **Feet/Cord Wrap.** Feet support oscilloscope in vertical position (face up) and serve as cord wrap for storing power cord.

39. VR103. **CH A ATTEN BAL Control** (under rubber plug). Step attenuator balance adjustment for Channel A trace.

40. VR101. **CH A DC BAL Control** (under rubber plug). Vertical dc balance adjustment for Channel A trace.

41. **CRT Trace Rotation Adjustment** (Models 1474, 1479 and 1479A). Trace tilt is adjusted by mechanical rotation of CRT for models with round CRT.

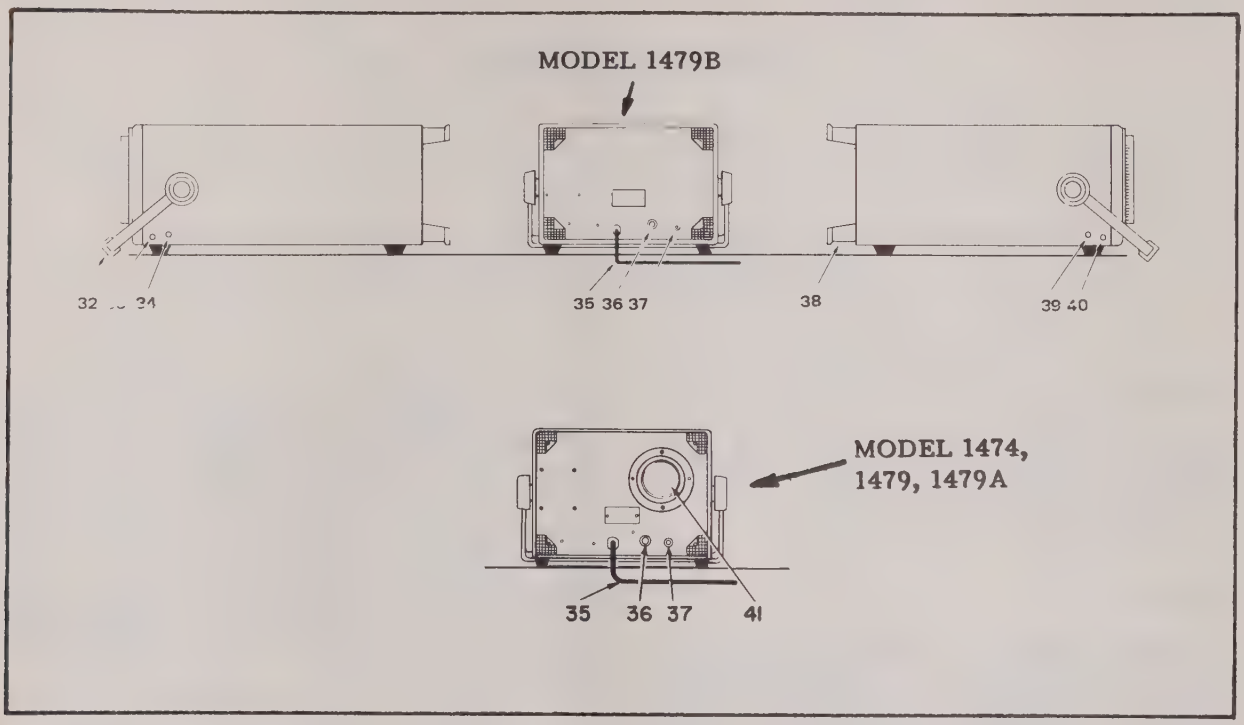


Fig. 5. Rear and Side Panel Facilities.

CIRCUIT DESCRIPTION

Unless otherwise stated, all information in this section applies equally to Models 1474, 1479, 1479A, and 1479B.

OVERVIEW

Refer to Fig. 6 and the following paragraphs for a general block diagram analysis of the oscilloscope's operation.

Vertical

These dual-trace oscilloscopes provide nearly identical attenuator and preamplifier circuits for channel A and channel B inputs. Channel B does include an inverter so that either normal or inverted polarity may be displayed.

The maximum input signal to the channel A preamplifier (Q101-Q106, Q109/Q110, and IC101) and channel B preamplifier (Q111-Q116, Q119-Q122, and IC102) is 40 mV peak-to-peak, which represents 8 divisions vertical deflection at 5 mV per division sensitivity. The attenuators reduce higher amplitude inputs to this level.

The outputs of the channel A and channel B vertical preamplifiers are applied to the delay line driver (Q123-Q126) after proper switching. Selection of the channel A or channel B signals for vertical deflection is accomplished by the vertical switching matrix (D101-D108). The vertical mode logic (IC103, IC104) allows the vertical switching matrix to pass only the channel A signal in CH A and X-Y modes, only the channel B signal in the CH B mode, alternately passes each in the DUAL mode (in chop or alternate sweep fashion), and simultaneously passes both (which are algebraically summed) in the ADD mode.

The channel A or channel B signal, whichever is allowed to pass through the vertical switching matrix, is amplified by the delay line driver circuits (Q123-Q126). The delay line delays the vertical deflection signal with respect to the start of the sweep so that the leading edge of high speed waveforms can be displayed on the CRT. The vertical output amplifier (Q401-Q414) provides power gain and its output is applied to the vertical deflection plates of the CRT.

Sweep

The main purpose of the horizontal amplifier and sweep board is to generate the sweep (a linear ramp or sawtooth waveform). A sweep generator consisting of the sweep control gate (IC1, IC2), Miller integrator (Q11, Q12, Q8), sweep amplifier (Q9, Q10), and holdoff timer (IC3) generates the linear ramp waveform. The negative going slope of the ramp wave sweeps the trace from left to right on the CRT. The sharp positive slope at the end of the ramp quickly returns the trace from right to left.

The sweep is amplified (Q25, Q28, Q29, Q30) and applied to the horizontal deflection plates of the CRT. The sweep control gate (IC1, IC2) synchronizes the unblanking of the CRT beam with the sweep (IC4c, IC4d), and in the dual-sweep mode synchronizes the vertical channel 1 and 2 signal with the sweep or chop oscillator (IC4a, IC4b). In X-Y operation, the sweep generator is disabled and the CH B input signal is fed directly into the horizontal preamplifier (Q25, Q28) as horizontal deflection of the trace.

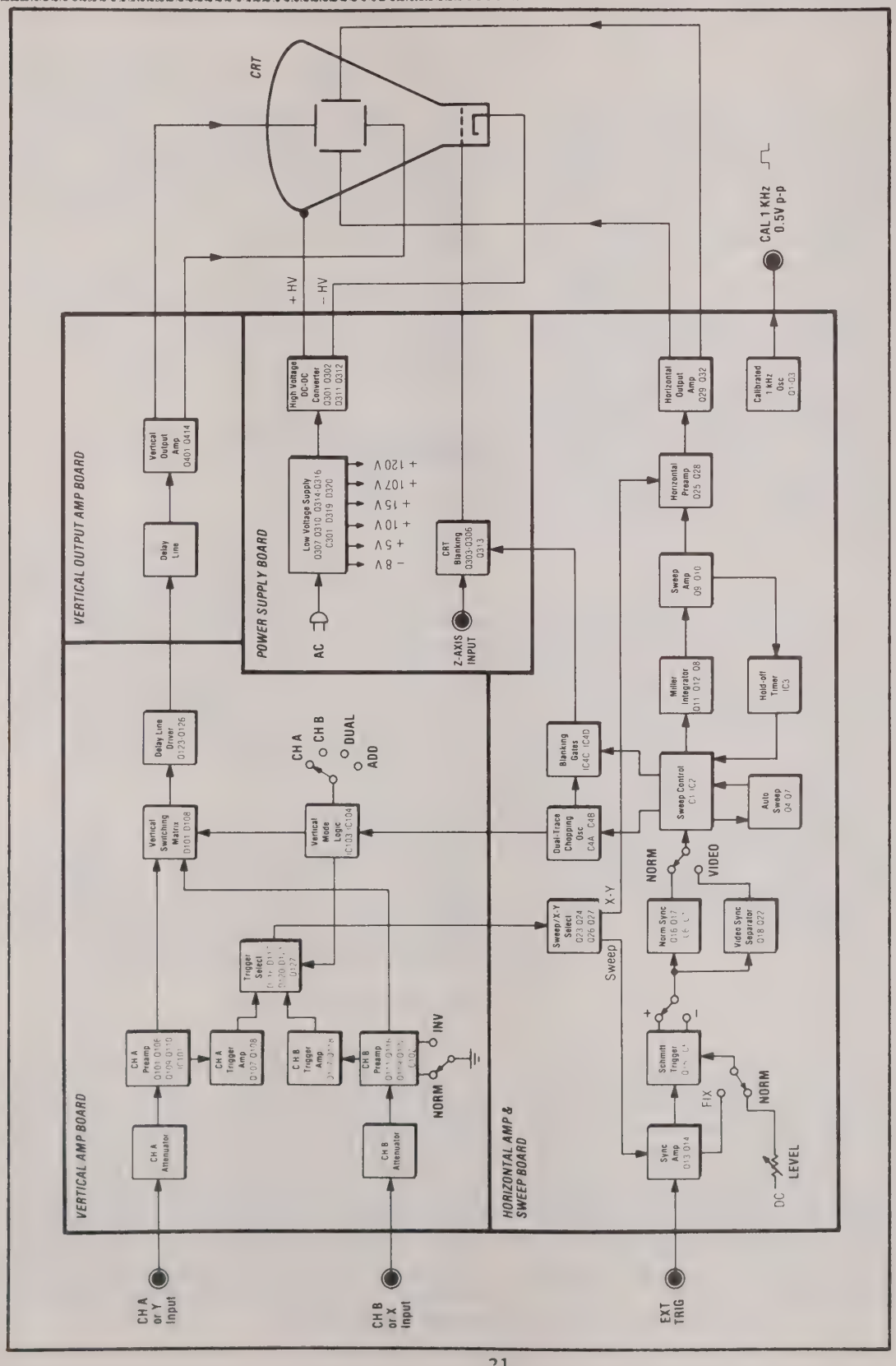


Fig. 6. Block Diagram.

Triggering

For stable display of a waveform, the sweep must be synchronized to the waveform being observed. Several triggering circuits offer the versatility required for a stable, synchronized display of a wide variety of waveforms. Triggering may be either from the channel A or channel B vertical signal (Q23, Q24, Q26, Q27) or an external source. For internal sync, the triggering signal is derived from the triggering circuits on the vertical amplifier board. A buffered sample of the channel A or channel B signal (Q107/Q108 or Q117/Q118) is selected by the trigger select circuit (D116, D117, D120, D121, Q127). In turn, the trigger select circuit is under control of the vertical mode logic circuit. The trigger selection circuit also supplies the channel B signal to the horizontal sweep board in X-Y operation.

For internal or external triggering, the trigger signal is amplified by sync amplifier (Q13, Q14) and converted into very sharp trigger pulses by Schmitt trigger (Q15, IC5). The threshold level of the Schmitt trigger is set by the LEVEL control (NORM) or is automatically set to the middle of the waveform (FIX). Either the positive or negative slope of the signal may be used as the trigger, as either polarity of the trigger signal is available from the Schmitt trigger. The VIDEO sync separator (Q18, Q22) may be selected for observing composite video waveforms (Models 1479A and 1479B only) or NORM (Q16, Q17, IC6, IC7) for all other types of waveforms.

Other Circuits

The intensity or brightness of the display is controlled by the CRT blanking circuit (Q303-Q306, Q313). This circuit amplifies the output of the blanking gate and shifts it to the correct dc level to blank the CRT during the sweep retrace period (when electron beam returns from right side to left side of screen) and during period of no sweep. Similarly, it unblanks the trace during the sweep period. It also allows a Z-axis input to be superimposed as intensity modulation.

The low voltage power supply (Q307-Q310, Q314-Q316, IC301, D319 and D320) provides all the regulated voltages for the operation of the oscilloscope except the CRT voltages. The high voltage dc-to-dc converter circuit (Q301, Q302, Q311, and Q312) provides the anode, cathode, focus grid, and acceleration grid voltages for the CRT.

A calibrated 1 kHz 0.5 V peak-to-peak square wave generator (Q1-Q3) provides a signal which may be used for a general check of voltage and time measurement accuracy.

VERTICAL ATTENUATOR AND PREAMPLIFIER

Introduction

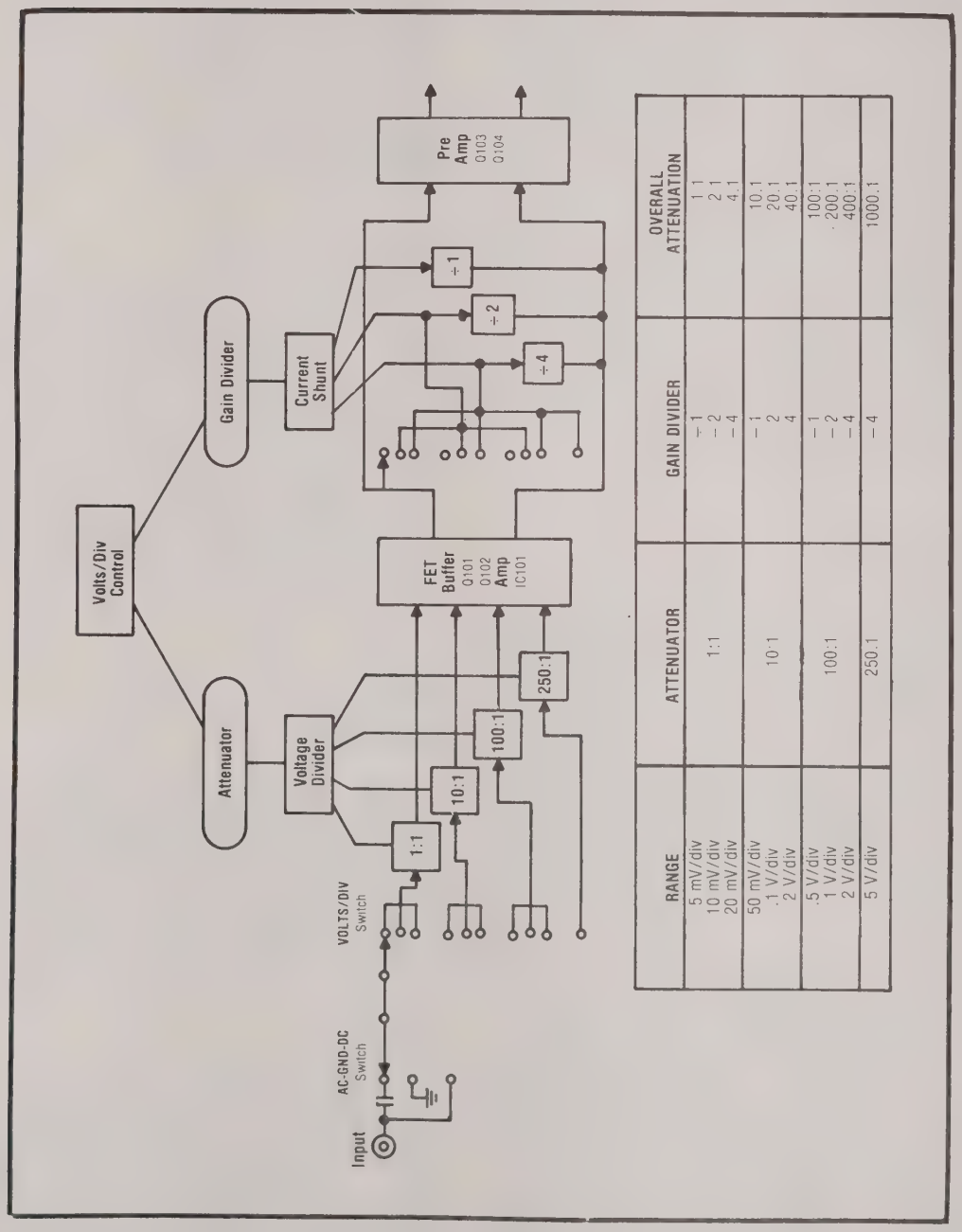
Refer to the vertical amplifier board schematic diagram in the back of the manual and to Fig. 7 which summarizes the overall operation of the vertical attenuator and preamplifier circuit. Channel A and channel B are nearly identical, so only one channel is described; the differences are described later. Fig. 8 is a more detailed circuit diagram, showing the individual transistors of transistor array IC101.

Switch S101

The AC-GND-DC switch, S101, capacitively couples the input in the AC position and directly couples it in the DC position. In the GND position, it grounds the input of the FET buffer and disconnects the input signal.

First Attenuator Section

The attenuator contains two sections, both of which are switched by the VOLTS/DIV control (S103). The first section is a four part voltage divider. The first three steps of the VOLTS/DIV control select a 1:1 divider ratio (no attenuation), the next three steps have a divider ratio of 10:1, the next three steps are 100:1, and the last step has a divider ratio of 250:1. Note on the schematic diagram that the resistor values are selected to always maintain a 1 megohm termination impedance for the input signal.



RANGE	ATTENUATOR	GAIN DIVIDER	OVERALL ATTENUATION
5 mV/div	1:1	−1	1:1
10 mV/div		−2	2:1
20 mV/div		−4	4:1
50 mV/div	10:1	−1	10:1
.1 V/div		−2	20:1
2 V/div		−4	40:1
.5 V/div	100:1	−1	100:1
1 V/div		−2	200:1
2 V/div		−4	400:1
5 V/div	250:1	−4	1000:1

Fig. 7. Vertical Attenuator and Preamplifier Circuit, Functional Block Diagram.

Buffer

A FET buffer follower (Q102) and amplifier (transistor array IC101) are located between the first and second attenuator sections (refer to Fig. 7 and 8). FET buffer follower Q102a presents very high input impedance. Negative overvoltage at Q101 is contained by diode D122. Positive overvoltage is clamped by Q102a. Q102a and Q102b are source coupled so that they develop two signals of opposite polarity which are applied to IC101c and IC101d respectively. Direct coupled differential amplifiers are employed throughout the vertical amplifier section, from this point to the vertical deflection plates. Combining the four transistors of transistor array IC101 onto a single chip protects against thermal drift and voltage flucuation. The VARIABLE control, VR102, continuously adjusts the gain of differential amplifier IC101a and e.

Second Attenuator Section

The second section of the attenuator is a current shunt in the preamplifier which acts as a gain divider. As the VOLTS/DIV control is rotated through all of its settings, the shunting of IC101a and e repeats in a 1/1 (no shunt, full gain), 1/2 (shunted to half gain), 1/4 (shunted to quarter gain) pattern. The single exception to this pattern is that the last two positions (2 V/div and 5 V/div) both select 1/4. The overall attenuation achieved by the first and second sections of the attenuator are summarized in Fig. 7.

DC Reference

The entire vertical preamplifier string is suspended between +5 V and -8 V. When the trace is centered, the dc reference is about 0 V. The variable dc balance adjustment (VR101) and the step balance adjustment (VR103) make minor adjustment to the dc reference to compensate for minor unbalance. Employment of direct coupled differential amplifiers with a variable dc reference improves vertical linearity when the signal being observed contains a dc component, or when the trace is uncentered with the POSITION control.

Preamplifier

Additional gain is provided by differential amplifier Q105 and Q106. Cascode amplifier Q109/Q110 provides good isolation between channels and prevents loading when the output of channel A is not selected. A sample of the channel A signal is available from trigger amplifier Q107/Q108 at all times, even when channel A is not displayed.

Channel B Differences

Channel B is similar to channel A execpt in two respects. First, although functionally similar, the interconnection of transistor array IC102 for channel B is essentially transposed as compared to IC101 for channel A. Note that the input, output, and other external connection pin arrangement is different. Second, either the normal or inverted polarity signal may be selected for channel B. CH B POLARITY switch S105 selects either Q119/Q122 or Q120/Q121, which are connected with opposite polarity outputs.

VERTICAL MODE LOGIC

Introduction

The vertical mode logic circuits are located on the vertical amplifier board. Refer to that schematic diagram in the rear portion of this manual. The mode of operation, CH A, CH B, DUAL, or ADD, is selected by MODE switch S106 and controlled by digital logic circuits IC103, IC104 and diodes D101-D108.

CH A Mode

When the CH A mode is selected, a low is placed at the set (S) input of IC104. The Q output is high and the $\overline{Q}$ output is low at this time. This reverse biases D101 and D104, which allows the channel A signal to the delay line driver amplifiers Q123-Q126. It also forward biases D107 and D108, which in turn reverse biases D105 and D106, blocking the channel B signal from the delay line driver amplifiers.

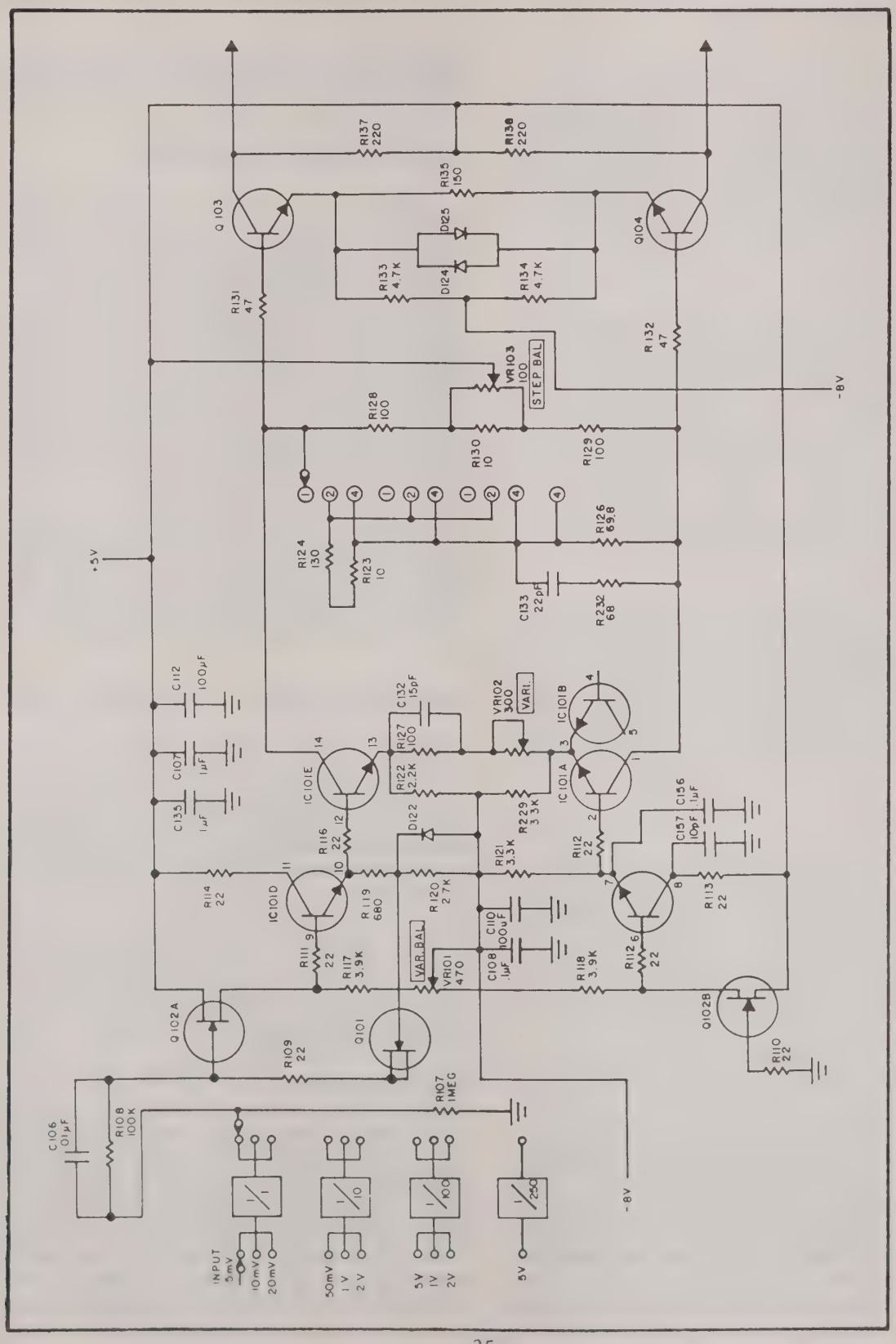


Fig. 8. Vertical Attenuator and Preamplifier Circuit, Circuit Detail.

CH B Mode

In the CH B mode, the reverse action occurs by applying a low to the reset (R) input of IC104. This causes the Q output of IC104 to go low and the $\overline{Q}$ output to go high, allowing the channel B vertical signal to be applied to delay line driver amplifiers Q123-Q126.

DUAL Mode

In the DUAL mode, both channels are displayed. For sweep speeds below 0.5 ms/div, IC104 outputs are switched by a 200 kHz clock pulse (CP) applied to the clock input of IC104. In this state, the Q and $\overline{Q}$ outputs of IC104 change state with each CP input. This action chops the trace into 5 µs segments, which are alternately switched between channel A and channel B to provide a dual trace. The clock pulse is generated on the sweep board (IC4a and IC4b) and coupled to IC104.

For sweep speeds equal to or faster than to 0.5 ms/div, the clock pulse (CP) is synchonized with the sweep. The Q and $\overline{Q}$ outputs of IC104 switch states after every sweep. This alternates the input signal to the delay line drivers so that channel A is displayed during one sweep and channel B during the next sweep.

ADD Mode

In the ADD mode, both the set (S) and reset (R) inputs of IC104 are low. In this state, both the Q and $\overline{Q}$ outputs of IC104 are high. The signals from both channel A and channel B are added algebraically and applied to delay line driver amplifiers Q123-Q126 via diodes D102, D103 (CH A), and D105, D106 (CH B).

X-Y Mode

The X-Y mode is selected by placing the SWEEP TIME/DIV switch on the sweep board to the CH B (fully clockwise) position. This switch has priority, and MODE switch S106 has no effect. Selection of the X-Y mode places a low on the $\overline{XY}$ input to the vertical amplifier board (P101 pin 2). Diode D119 becomes forward biased, placing a low on the set (S) input of IC104, and routing the channel A signal to the vertical amplifier (Y axis).

VERTICAL OUTPUT AMPLIFIER

Refer to the vertical output amplifier schematic diagram. The differential output signals from delay line drivers Q125 and Q126 are routed through delay line L404 to two stages of differential amplifiers, Q401-Q404. These connect to two emitter followers, Q405 and Q406, which drive cascode amplifiers Q408-Q411. Four transistors, Q412, Q418, Q413, and Q419, provide current sources for cascode amplifiers Q408-Q411. The output of the cascode amplifiers is applied to the vertical deflection plates of the CRT.

Negative feedback from the cascode amplifiers is applied to the base of Q405 and Q406 via FET inverters Q414 and Q415. Emitter followers Q416 and Q417 drive current source transistors Q418 and Q419 when extra current is required for fast signals.

TRIGGER CIRCUITS

Introduction

Most of the triggering circuits are located on the sweep board, although the internal triggering signal originates from the channel A or channel B vertical amplifier. Refer to the corresponding schematic diagram. There are several versions of trigger circuits used between the introduction of Model 1474 and Model 1479B at the time of printing this service manual. Each version is described, but requires reference to the corresponding overall schematic diagram.

Trigger Selection

Refer to the vertical amplifier schematic diagram. Both the CH A and CH B trigger amplifiers (Q107-Q108 and Q117-Q118) feed Q127. The mode logic from IC103 determines which signal shall be selected as the trigger. In the CH A mode, D117 and D120 are reverse biased to allow the channel A signal to act as the trigger (D116 and D121 are forward biased

to lock out CH B). The reverse holds for the CH B mode. In both DUAL and ADD modes, CH A signal is the trigger unless input from IC103 indicates the SOURCE switch is set to CH B.

Trigger Source

The trigger output from Q127 is routed to trigger source switch S3. In Models 1474 and 1479, this route is through Q20 and Q16. In Models 1479A and 1479B, the route is through Q24 and Q23. Q20 and Q16 (or Q24 and Q23) form a gate that passes the trigger signal in normal sweep operation. In X-Y operation, the gate blocks the trigger signal and routes it into the horizontal amplifier. SOURCE switch S3 selects the trigger: CH A, CH B, external trigger (EXT), or rectified and filtered modulation of CH A and CH B (AM DET). The AM DET position and associated rectifier and filter circuit are not included in Model 1474. In its place is a 10:1 voltage divider and a switch position labeled EXT 1/10.

Trigger Coupling

The selected trigger source signal is routed to a FET follower through COUPLING switch S4, either directly in the DC position or capacitively in the AC position. The signal is coupled through a low pass filter in the HF REJ position and a high pass filter in the LF REJ position.

Adjustable Trigger Level

When the FIX/NORM switch is set to NORM (the switch positions are labelled AUTO LEVEL and NORM on Model 1474), the trigger level is adjustable with TRIG LEVEL control VR8. Due to design and production changes, there were three versions of triggering circuits between the introduction of Model 1474 and the printing of this service manual. All three versions are described below. Refer to the corresponding overall schematic diagram.

Model 1474 and 1479

The selected trigger signal from FET follower Q12 is dc coupled to emitter follower Q13, which drives one input (pin 2) of Schmitt trigger IC5. The TRIG LEVEL control, VR8, sets a dc reference level at the other input (pin 1) of IC5 by way of emitter follower Q14. IC5 acts as a high gain diferential amplifier, or Schmitt trigger. When the signal of pin 2 exceeds the dc level on pin 1, the output of IC5 changes states and results in a sharp trigger. When the pin 2 level drops below the pin 1 level, a trigger signal of the opposite polarity is developed.

Earlier Model 1479A

This circuit description applies to Model 1479A up to serial no. 99-09600. For serial no. 99-09601 and higher, the circuit configuration is the same as described below for Model 1479B. The selected trigger signal from FET follower Q13 is dc coupled to emitter follower Q14, which drives one input (pin 2) of Schmitt trigger IC5. The TRIG LEVEL control, VR8, sets a dc reference level at the other input (pin 1) of IC5 by way of emitter follower Q15. IC5 acts as a high gain diferential amplifier, or Schmitt trigger. When the signal of pin 2 exceeds the dc level on pin 1, the output of IC5 changes states and results in a sharp trigger. When the pin 2 level drops below the pin 1 level, a trigger signal of the opposite polarity is developed.

Later Model 1479A and Model 1479B

The selected trigger signal from FET follower Q13 is dc coupled through emitter follower Q14 and FET buffer Q15A, which drives one input (pin 2) of Schmitt trigger IC5. The TRIG LEVEL control, VR8, sets a dc reference level at the other input (pin 1) of IC5 by way of FET follower Q15b. IC5 acts as a high gain diferential amplifier, or Schmitt trigger. When the signal of pin 2 exceeds the dc level on pin 1, the output of IC5 changes states and results in a sharp trigger. When the pin 2 level drops below the pin 1 level, a trigger signal of the opposite polarity is developed.

Automatic Triggering Level

When the FIX/NORM switch is set to FIX, the triggering LEVEL control is disconnected and has no effect. Instead, the triggering level is automatically set at the center of the waveform being used as the trigger. The FIX mode is very convenient when checking for the presence or absence of waveforms at several points, or checking amplitude only, because no LEVEL adjustments are required when the displayed signal changes amplitude or the dc component of the displayed signal changes. However, this mode should not be used for phase or timing measurements. For those measurements, the TRIG LEVEL control should be used to control the triggering point.

There are three versions of the FIX circuit, corresponding to the three versions of adjustable triggering level described above.

Model 1474 and 1479

With S201 set to the FIX position (AUTO LEVEL position for Model 1474), the trigger signal is ac coupled from Q12 to Q13 via C28; thus the trigger input to IC5, pin 2 is signal only with no dc component. The ac coupled trigger signal from C28 is also routed to detector network D13, D14, C29, R64, R65, R68. This network develops a dc voltage equal to the average level of the ac component of the trigger signal and applies it via Q14 as trigger threshold to IC5, pin 1. Thus, the triggering signal itself is used to derive the trigger threshold. The trigger threshold level is automatically set at the center (average) of the triggering waveform.

Earlier Model 1479A

With S203 set to the FIX position, the trigger signal is ac coupled from Q13 to Q14 via C47; thus the trigger input to IC5, pin 2 is ac coupled (signal only, no dc component). The ac coupled trigger signal from C47 is also routed to detector network D19, D20, C48, R66, R67, R68. This network develops a dc voltage equal to the average level of the ac component of the trigger signal and applies it via Q15 as trigger threshold to IC5, pin 1. Thus, the triggering signal itself is used to derive the trigger threshold. The trigger threshold level is automatically set at the center (average) of the triggering waveform.

Later Model 1479A and Model 1479B

For this version, the trigger signal from Q13 is directly coupled through Q14 and Q15a to pin 2 of IC5, just as it is for adjustable trigger level operation. Thus, both the ac and dc component of the trigger signal are applied to pin 2 of IC5. The output of Q14 is also applied to detector circuit Q23, Q24, C47, C48, and R66-R69. This detector circuit develops a dc voltage equal to the dc component plus the average of the ac component. With S203 set to the FIX position, the output of the detector replaces the output from the TRIG LEVEL control. This dc voltage is applied by way of Q15b as trigger threshold to pin 1 of IC5. Thus, the triggering signal itself is used to derive the trigger threshold. The trigger threshold level is automatically set at the center (average) of the triggering waveform.

Slope Selection

Model 1474 and 1479

Both polarities from IC5 are available at SLOPE switch S5. Either polarity may be selected and applied through emitter follower Q15 and inverters IC1c and IC1d to the clock input of sweep control multivibrator IC2.

Model 1479A and 1479B

Both polarities from IC5 are applied to the normal sync gates through Q16 and Q17. SLOPE switch S5 enables normal sync gate IC6b in the "+" position. This allows the signal from Q16 to be gated through IC6b, IC7c and IC7d. In the "-" position, IC6d is enabled to allow the Q17 signal to be gated through IC6c, IC7d, and IC7c.

Video Sync

Models 1479A and 1479B include a video sync separator circuit. When the VIDEO/NORM switch is in the VIDEO position, IC7

inhibits the normal sync signals and allows the video sync circuits (Q18-Q22) to supply the sweep trigger. The SLOPE switch selects either polarity output from IC5 as the input to Q18-Q20. For sweep times of 0.5 s to 0.1 ms/div, Q22 and Q21 are turned on. This connects capacitor C58 to the coupling circuit between Q19 and Q20. The capacitor shunts short duration horizontal (line) sync pulses and passes longer duration vertical (frame) sync pulses to Q20. These slower sweep times are used for viewing vertical frames or video fields. For sweep times of 50 ms to 0.2 µs/div, Q21 and Q22 are turned off and C58 is disconnected. The faster horizontal sync pulses reach Q20 and are used for viewing horizontal lines of video.

Normal and Automatic Triggering

The trigger pulse output of IC7c (Model 1479A and 1479B) or Q15 (Model 1474 and 1479) is coupled through inverters IC1d and IC1c to the clock input of the sweep control multivibrator, IC2. This pulse synchronizes the sweep to the waveform being used as the source. If no trigger is present, sweep is not developed unless PULL AUTO switch S4 is closed. If S4 is closed, Q7 (Model 1479A and 1479B) or Q25 (Model 1474 and 1479) is enabled and IC2 will run free in the absence of a trigger signal. Transistors Q4, Q5, and Q6 detect the presence of the trigger signal and inhibit Q7 (or Q25) when a trigger signal is present.

X-Y Mode Control

The X-Y mode is selected by setting the SWEEP TIME/DIV switch on the sweep board to the CH B position. This turns on IC1b, which disables the sweep generator. It also provides the low $\overline{XY}$ signal to the vertical amplifier board at P101, pin 2. This low is applied through diode D119 to IC104, which selects the channel A signal for vertical deflection (Y axis). The $\overline{XY}$ signal is also applied to IC103 which selects the channel B trigger signal via Q127 for horizontal deflection (X axis). The channel B trigger signal is gated to the horizontal amplifiers by Q17 and Q19 (Model 1474 and 1479) or Q25-Q27 (Model 1479A and 1479B).

HORIZONTAL SWEEP

Introduction

The horizontal sweep circuits are located on the sweep board. Refer to that schematic diagram for the following circuit description. The components used in the horizontal sweep circuit have different component designations for Models 1474 and 1479 than for Models 1479A and 1479B, although circuit operation is essentially the same. The following circuit description uses the component designations found on the Model 1479A and 1479B schematic diagrams. To adapt the description to Models 1474 and 1479, compare diagrams and substitute corresponding component designations.

Sweep Generation

When a trigger pulse is received at the clock or reset input of IC2, its Q output, pin 8, goes low. This allows the horizontal ramp integrator (Q11, Q12 and resistor and capacitors) to begin the sweep. The sweep time is determined by the RC constant of the timing resistors and capacitors which are selected by the SWEEP TIME/DIV control (S2). At the slowest sweep times, C22 is the selected sweep capacitor, and at faster sweep times C23, C24 (trimmed by TC1), or C25 (trimmed by TC2) is selected. The sweep timing resistors are R27 thru R32, which are selected in a repeating pattern for each sweep capacitor.

Sweep Amplifiers

The output of the decreasing linear ramp integrator (Q11 and Q12) is fed into Q9 and Q10 and then to the horizontal amplifier section (Q24-Q32). This amplifier drives the horizontal deflection plates of the CRT. The horizontal amplifier stages are directly coupled and a variable dc reference is established by the horizontal POSITION control. In normal operation, the gain of amplifier Q29/ Q30 causes the sweep ramp to produce slightly over 10 divisions horizontal deflection. To expand the sweep for closer waveform observation, the X5 MAG switch provides a five times gain increase in the Q29/Q30 circuit.

End of Sweep

A second output of the integrator, an increasing linear ramp from the emitter of Q10, is fed to the sweep holdoff timer (IC3, pin 6). When the decreasing ramp voltage has swept the trace to the right hand side of the CRT, the increasing ramp voltage reachs the threshold setting of IC3. This causes the output of IC3 (pin 3) to go low. This low sets the Q output of the sweep control flip-flop (IC2) high, which ends the sweep by turning on Q8 and discharging the sweep capacitor. This action resets the trace to the left hand side of the CRT.

Sweep Holdoff

A finite sweep holdoff time is required to discharge the sweep capacitor before the next sweep can begin. A progressively longer holdoff time is required to completely discharge the larger value sweep capacitors at slower sweep times. The holdoff time is determined by the capacitor tied to IC3, pin 2 and the optimum value for each sweep is set by the SWEEP TIME/DIV control. The sweep holdoff time capacitor connected to pin 2 of IC3 is discharged through R25 to reset IC3 (pin 7). When the pin 7 voltage drops to 1.6 volts, the holdoff timer output (IC3, pin 3) is triggered high. This resets IC2, which is now ready to accept the the next trigger pulse. While the holdoff timer is reset, the holdoff capacitor is recharged by IC3 pin 7.

Sweep Pulse

As a result of the actions just described, sweep control flip-flop IC2 produces a positive going pulse from its $\bar{Q}$ output that is coincident with the sweep. This waveform is used in IC4 to synchronize trace blanking with the sweep and to synchronize the vertical display with the sweep. IC4a, b, and c generate the CP (clock pulse) signal which is used to alternately select vertical channel A and B in dual trace operation At slow sweep times, IC4a and b operate as the free running chop multivibrator, and the CP signal switches state at approximately 200 kHz during the sweep period. IC4b is gated off between sweeps. At faster sweep times, IC4a is turned off and IC4b and c operate as inverters. The CP signal follows the sweep pulse and causes the vertical switching matrix to alternately display channel A during one sweep and channel B during the next. IC4d inverts the sweep pulse to produce a negative going blanking pulse that is coincident with sweep. This pulse is the input to the blanking circuit, which consequently reduces the trace intensity between sweeps so the reset of the trace cannot be seen.

Sweep control flip-flop IC2 will not respond to trigger input during sweep and holdoff periods, but is again enabled at the end of the holdoff period. The next trigger pulse can come from either the clock input (pin 12) or from the reset input of Q6 if the AUTO TRIGGERING circuit is on.

INTENSITY CIRCUIT

Introduction

The visible display on the CRT occurs when the electron beam strikes the flouresecent coating on the inside of the CRT screen. Brightness or intensity is basically dependent upon the voltages applied to the CRT. A simplified schematic of this circuit is shown in Fig. 9.

Cathode and Anode Voltage

The total acceleration potential for the CRT electron beam is about 6 kV for Model 1479B, and about 4.7 kV for Models 1474, 1479, and 1479A. This is the sum of the cathode voltage (-1.5 kV for Model 1479B, -1.9 kV for the others) and the anode voltage (+4.5 kV for Model 1479B, +3.8 kV for others). This voltage is supplied by the high voltage power supply which is described separately.

Intensity Grid

Beam current is controlled by the voltage on the intensity grid with respect to the cathode. In the quiescent state with no sweep, the intensity grid is roughly 85 volts negative with respect to the cathode. This completely cuts off beam current and blanks the retrace.

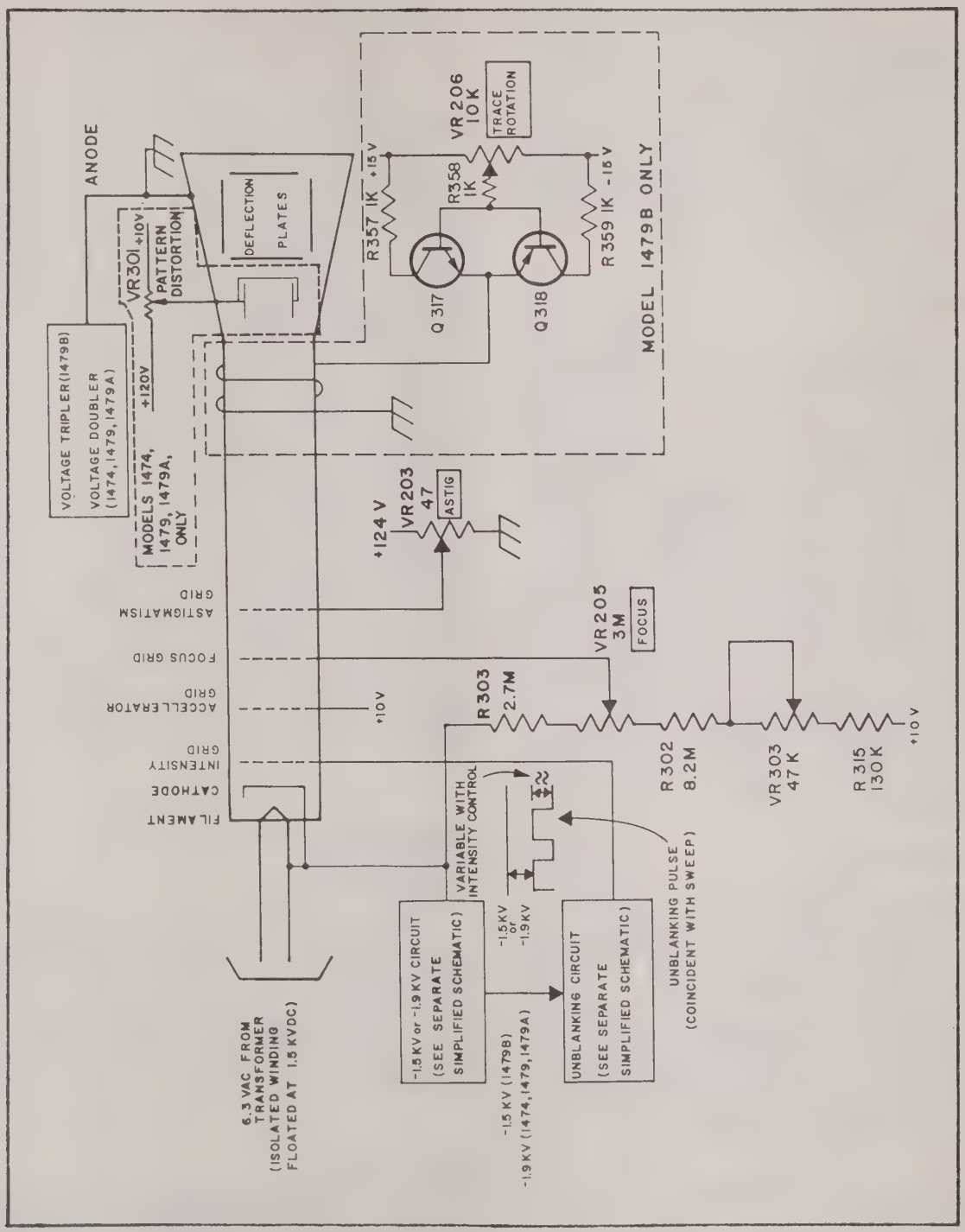


Fig. 9. CRT Operating Voltage Circuit.

During the sweep, a positive going pulse from the blanking circuit reduces the negative bias on the intensity grid, which permits electron beam current and unblanks the trace. The INTENSITY control adjusts the amplitude of the unblanking pulse. A further explanation of the blanking circuit is given in the "Blanking Circuit" paragraph.

Other Grids

The electron beam is also affected by the accelerator grid, focus grid, and astigmatism grid. The accelerator grid is fixed at +10 volts, which is about 1.5 to 1.9 kV positive with respect to the cathode. A second accelerator grid is internally connected to the same pin of the CRT to provide post-deflection (after vertical and horizontal deflection plates) acceleration. The electron beam is concentrated by the potential on the focus grid. FOCUS control VR205 is connected in a voltage divider between the high voltage supply and +10 volts for an adjustment range of roughly -1.3 to -1.7 kV. The astigmatism grid further shapes the electron beam. ASTIG control VR203 is simply connected from the +124 volt supply to chassis to obtain the necessary voltage range for correction of astigmatism.

Trace Rotation

For Model 1479B only, regulated +10 V and -10 V is applied across emitter followers Q317 and Q318. This permits TRACE ROTATION control VR206 to adjust emitter voltage through the +10 V to -10 V range. A dc current, variable in magnitude and of either polarity, is applied through the trace rotation coil around the CRT. The resultant magnetic field rotates the electron beam of the CRT to electrically adjust trace tilt.

Pattern Distortion

For Models 1474, 1479, and 1479A, a set of pattern distortion deflection plates permits a dc voltage from VR301 to compensate for vertical and horizontal deflection plate unbalance.

HIGH VOLTAGE POWER SUPPLY

Refer to the simplified schematic of the high voltage and blanking circuit shown in Fig. 10. The unregulated +15 volts from the low voltage power supply drives a dc-to-dc converter consisting of Q301, Q311, Q312, and T301. Transformer T301 and transistor Q301 form an oscillator which operates at approximately 20 kHz. A high voltage 20 kHz ac is thus developed across the secondary of T301. The transformer step-up ratio is different for Model 1479B than for Models 1474, 1479, and 1479A. The transformer in Model 1479B provides about 1.5 kV, versus approximately 1.9 kV for the other models. The secondary voltage of transformer T301 is rectified by D301 (Model 1479B) or D303 (Models 1474, 1479, or 1479A) and filtered by C305 as the dc cathode potential. Regulation is achieved by feedback of the high voltage dc through a voltage divider to Q312 and Q311, thus controlling the peak primary current of T301. VR303 adjusts the high voltage. The secondary output of T301 is applied to voltage doubler that provides +3.8 kV for the anode in Models 1474, 1479, 1479A. In Model 1479B a voltage tripler is used which develops +4.5 kV for the CRT anode.

BLANKING CIRCUIT

Introduction

The blanking circuit blanks the CRT during the retrace period (when electron beam returns from right side to left side of CRT) and unblanks the CRT during sweep. This is accomplished by setting the instantaneous dc voltage on the intensity grid with respect to the cathode.

Boost Voltage

The potential difference between the intensity grid and the cathode is developed by a boost voltage circuit including transformer T301, transistor switch Q302, coupling capacitor C308 and rectifier diodes D304, D305. A simplified schematic of this circuit is shown in Fig. 10.

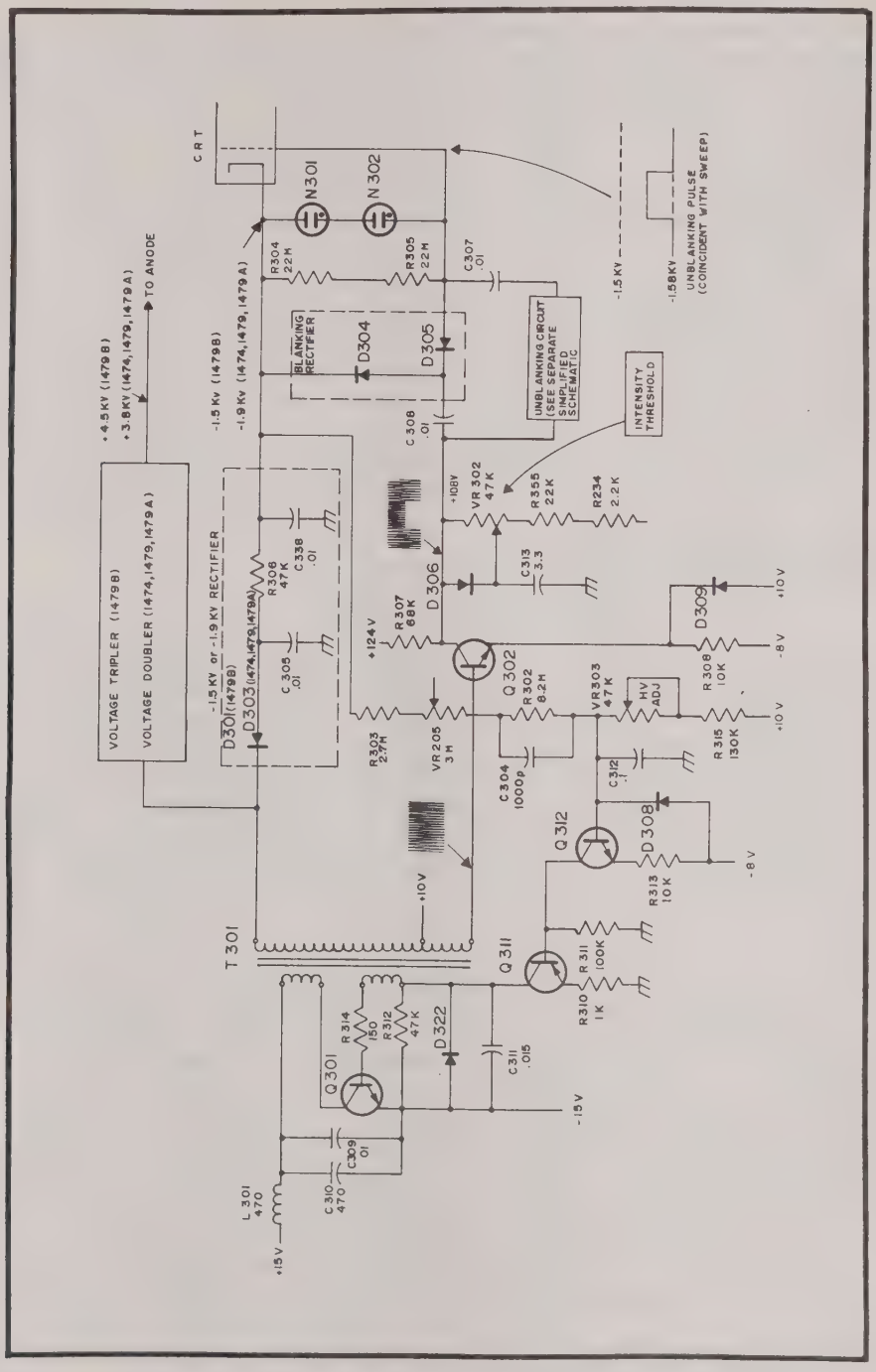


Fig. 10. High Voltage Circuit.

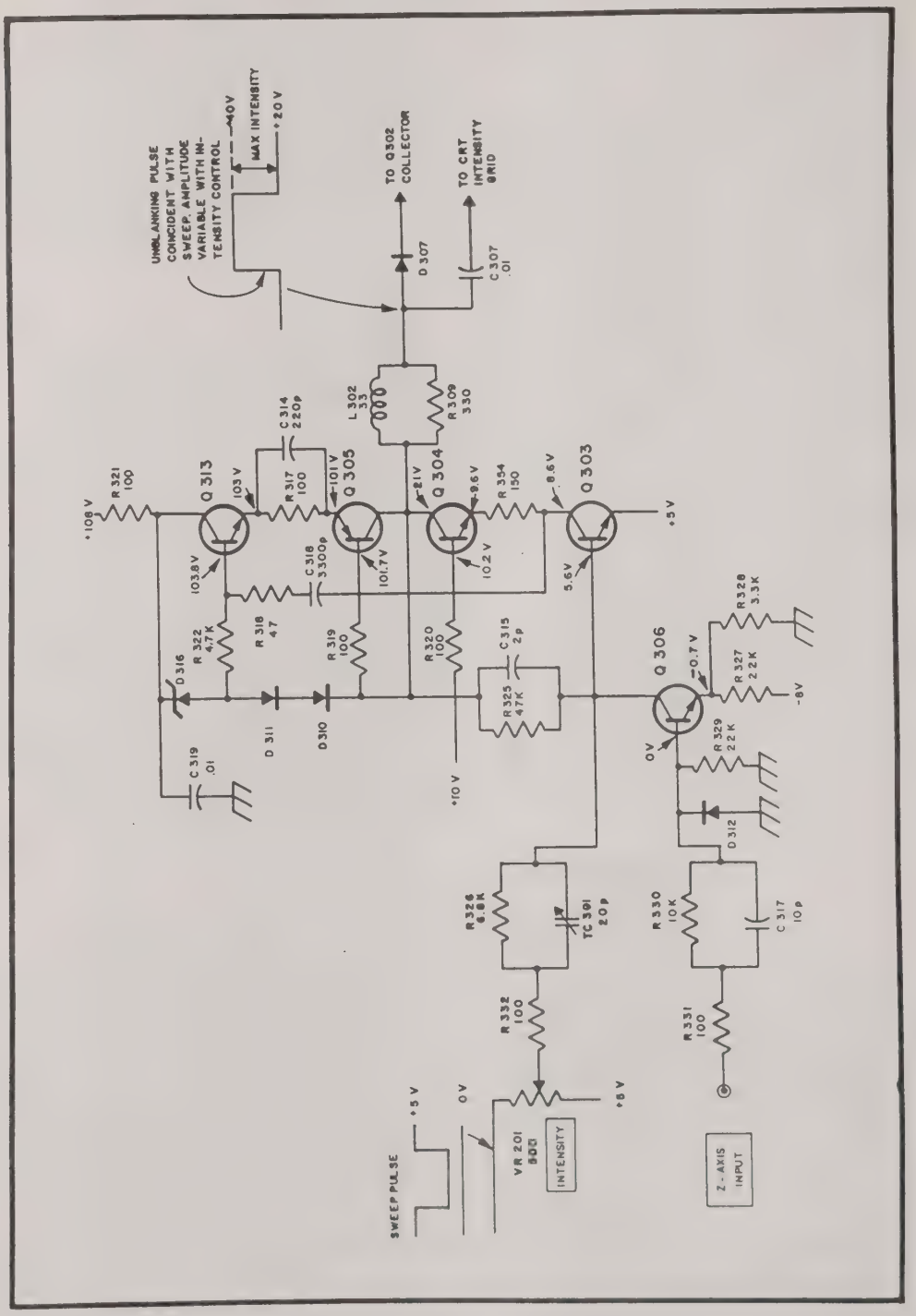


Fig. 11. Unblanking Circuit.

A tapped secondary winding on high voltage transformer T301 applies a part of the dc-to-dc converter's switching voltage to transistor switch Q302. The voltage divider components in the Q302 circuit determine the conduction and cutoff limits. That portion of the transformer switching voltage within these limits is capacitively coupled through C308 which re-references the alternating voltage to the CRT cathode voltage (-1.5 or -1.9 kV). Diodes D304 and D305 are the boost voltage rectifiers. Diode D304 clamps the positive most swing of the 20 kHz switching voltage to the reference voltage (-1.5 or -1.9 kV) and diode D305 rectifies the negative swing into a dc voltage that is about 85 volts negative with respect to the cathode of the CRT.

Unblanking

During the sweep, a postive-going unblanking pulse is dc coupled to Q302, changing its conduction level. As a result, a lower amplitude 20 kHz switching voltage is applied to the boost voltage rectifier. This instantaneous reduction in boost voltage reduces the bias on the intensity grid of the CRT, which permits electron beam current and unblanks the trace during the sweep. The unblanking pulse is also coupled through C307 for unblanking at higher speeds.

The unblanking pulse is developed from the negative going sweep pulse (J212, pin 2) which is coincident with each sweep. The circuits which convert the sweep pulse into the unblanking pulse are shown in Fig. 11. INTENSITY control VR201 adjusts the amplitude of the pulse which is applied to the base of transistor Q303. Transistors Q303, Q304, Q305, and Q313 provide amplification and dc level shifting. The output from Q304/Q305 is referenced to about +20 volts dc, and at maximum intensity, increases to about +40 volts during sweep. At lower intensity, the amplitude of the unblanking pulse is corresponding lower.

Intensity Modulation

Intensity modulation from an external signal at the Z-AXIS INPUT jack is superimposed on the blanking signal by Q306. A positive going signal increases brightness. The input to Q306 is TTL compatible; i.e., input markers of 3 to 5 volts amplitude will be visible as intensified portions of the sweep.

CALIBRATION VOLTAGE

Multivibrator circuit Q2 and Q3 on the sweep board generate a 1 kHz square wave. Variable resistors VR2 and VR3 are used to adjust the frequency (pulse width) of the positive and negative portions, respectively. The output is developed across amplifier Q1. Variable resistor VR1 adjusts the output level to 0.5 volt peak-to-peak.

LOW VOLTAGE POWER SUPPLY

Introduction

A simplified schematic of the low voltage power supply is shown in Fig. 12. The main power transformer has two secondaries. The first is a center tapped 28 volt (equivalent to two 14 volt) winding which is the source of the +15 V, +10 V, -8 V, and +5 V supplies. The other is a 120 volt winding which is the source of the +124 and +108 V supplies.

+15, +10, and +5 Volt Supply

The center tapped 28 volt ac output of the main power transformer is applied to diode bridge D319. The approximate 30 volt dc output is connected to form the unregulated +15 and -15 volt dc source. The unregulated +15 volt supply is fed into Q308, Q315, and Q316 to create a regulated +10 volts. In turn, +10 volt supply is fed into Q307 and Q314 to create the +5 volt supply.

-8 Volt Supply

The negative polarity output of diode bridge D319 is regulated to -8 volts by IC301a and Q309. The adjustable -8 volts is used as reference by the +10, +5, +124 and +108 volt supplies, and thus adjusts all regulated voltages. In fact, the recommended adjustment procedure is to measure and accurately set the +108 V output.

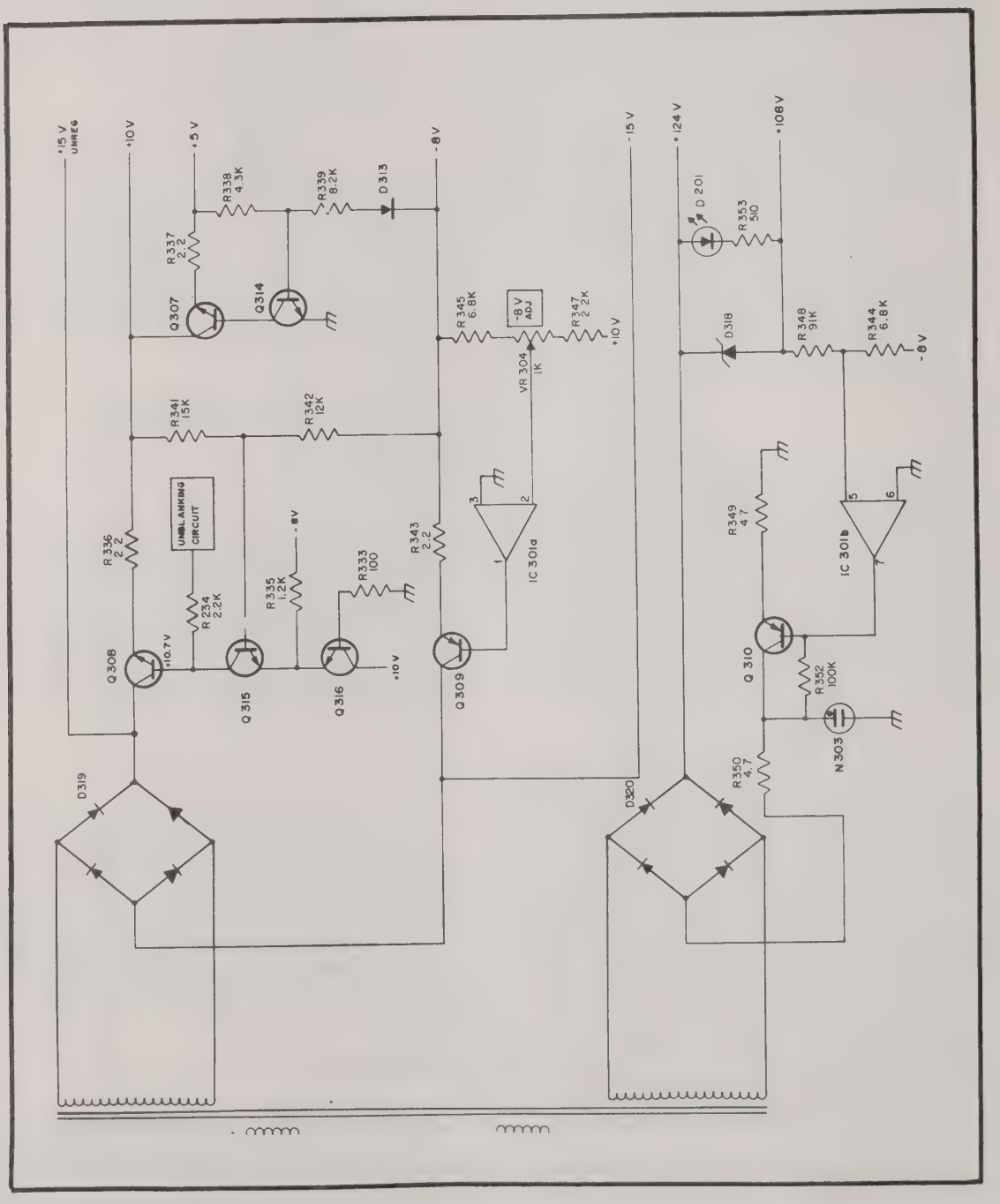


Fig. 12. Low Voltage Power Supply.

+124 and +108 Volt Supply

The 120 volt secondary of the main power transformer is rectified by diode bridge D320 and regulated in the circuit return leg by Q310 and IC301b to create +124 volts. Zener diode D318 drops part of the power to a regulated +108 volts. The values of +124 volts and +108 volts are specified on the schematic for Model 1479B, while values of +120 volts and +107 volts are given for Models 1474, 1479, and 1479A. Circuit operation is identical and the difference is merely in the adjustment.

OPERATOR MAINTENANCE

WARNING

To prevent electrical shock, do not perform servicing that requires removal of the covers unless you are qualified to do so. Exposed high voltage, up to 6,000 volts is present when covers are removed. The following procedures do not require removal of the top or bottom cover.

ASTIGMATISM

To adjust the CRT for the clearest sharpest image:

1. Set the SWEEP TIME/CM switch to CH B (X-Y operation) and set both channel A and B AC-GND-DC switches to the GND position. This will produce a dot on the screen.

2. With the INTENSITY control set about mid-range, adjust both the FOCUS control and the ASTIG screwdriver control on the front panel for the sharpest roundest spot on the screen. Do not readjust the ASTIG after this step.

CAUTION

Never allow a spot of high brillance to remain stationary on the screen for more than a few seconds. The screen will be permanently burned.

DC BALANCE

1. Set scope controls for a single horizontal trace on Channel A (AC-GND-DC switch to GND position and AUTO sweep).

2. Observe the trace while rotating Channel A VARIABLE control from maximum clockwise to maximum counterclockwise.

3. If the trace moves vertically, adjust VR101 (item 40, Fig. 5), accessible through left side of ocilloscope case, for mimimum or zero movement when performing step 2.

4. Observe the trace while rotating Channel A VOLTS/DIV switch through 5 mV, 10 mV, and 20 mV positions.

5. If the trace moves vertically, adjust VR103 (item 39, Fig. 5), accessible through left side of ocilloscope case, for mimimum or zero movement when performing step 4.

6. Repeat steps 2 thru 5 to eliminate interaction between the balance adjustments.

7. Repeat the procedure for Channel B using the variable resistors accessible through the right side of the case (VR106 and VR108 items 33 and 34, Fig. 5).

CALIBRATION CHECK

A general accuracy check can be made by displaying the CAL 1kHz ⎍⎍ 0.5 V p-p terminal output on the screen. This output terminal is factory adjusted to provide a square wave of 0.5 volt peak-to-peak amplitude at one millisecond per cycle. At 0.1 V/div this will produce 5 divisions of vertical deflection when the VARIABLE controls are set to CAL. The 10 mV/div range may be used to check the 10:1 attenuation of the probe (5 divisions of deflection will result).

With a 0.1 ms/div sweep time and VARIABLE set to CAL, one cycle of the waveform should occupy 10 divisions. At 1 ms/div, 10 cycles will span the ten divisions, while 2 cycles will cover the 10 divisions using 5X magnification.

PROBE COMPENSATION

Probe compensation matches the probe capacitance to a specific oscilloscope input. For best results, compensate both probes initially and do not interchange the channel A and B probes. Whenever another probe is used, adjust its probe compensation before taking any measurements. To compensate probes:

1. Connect probes to both input jacks. Connect ground clip of the probe to oscilloscope ground terminal and touch both probes to CAL 1 kHz ⎍ 0.5 V p-p terminal.

2. Select CH A mode.

3. Set oscilloscope controls to display 3 or 4 cycles of CAL square wave at 5 or 6 divisions amplitude.

4. Adjust compensation trimmer on probe for optimum square wave form (minimum overshoot, rounding off, and tilt) as shown in Fig. 13.

5. Repeat steps 1 thru 4 for CH B.

TRACE ROTATION

For accurate measurments, the trace must be exactly parallel with the horizontal lines of the graticule scale. Trace tilt is corrected by the following adjustment procedure.

For Model 1479B:

Trace rotation is adjusted by the screwdriver control on the front panel. Adjust trace to be exactly parallel with the horizontal scale line on the graticule.

For Models 1474, 1479, 1479A:

Loosen two screws on the rear panel CRT cover (Fig. 14). Grasp and rotate cover to align horizontal trace with horizontal scale, then re-tighten the two screws.

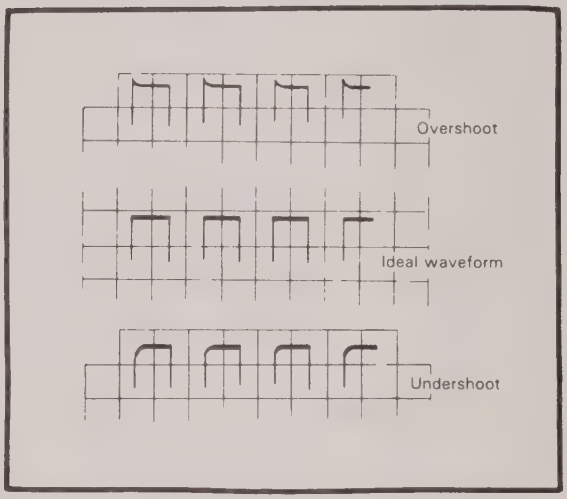


Fig. 13. Probe Compensation Waveform.

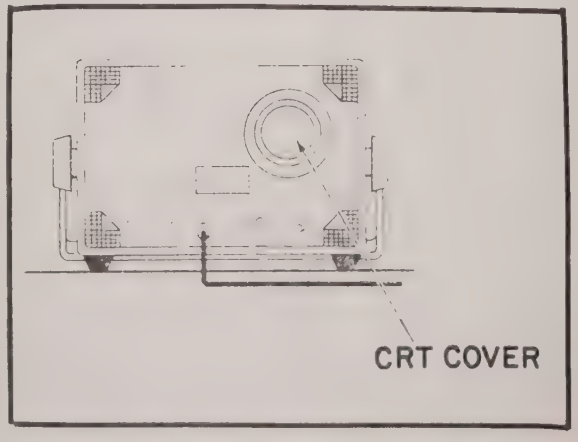


Fig. 14. Trace Rotation Location.

FUSE REPLACEMENT

The main power fuse (F1) will not normally open unless there is a problem in the unit or an operational error. It is recommended that the reason for the blown fuse be determined before the fuse is replaced. The main power fuse is replaced by unscrewing the fuse cap on the rear panel (item 37, Fig. 5), installing a new fuse (fast blow 0.7 amp for 120 VAC or fast blow 0.3 amp for 240 VAC), and replacing the fuse cap.

WARNING

This service manual is intended for use by qualified electronics technicians only. To avoid electrical shock, do not perform servicing unless you are qualified to do so. High voltages up to 6000 V dc are present when this instrument is operating. Remember that a high voltage charge may be retained indefinitely, especially at the CRT socket and anode cap. Discharge high voltage capacitors with a grounded test lead after removing power. Line voltage (120 or 240 VAC) is present on the power input circuit whenever the ac power cord is connected to a live outlet, even if the scope is turned off. Observe all high voltage safety precautions when the housing is removed from the oscilloscope. Contacting exposed high voltage could result in fatal electric shock.

REMOVING THE CASE

The oscilloscope case is secured by eleven Phillips head screws. The case is in two sections. The top section is secured by seven screws and the bottom section is secured by four screws. The locations of these screws are shown in Fig. 15.

FUSE REPLACEMENT

The main power fuse (F1) is in series with the primary of the power transformer. This fuse is accessible from the rear panel and can be changed without removing the case. the procedure is covered in the OPERATOR MAINTENANCE section of the manual.

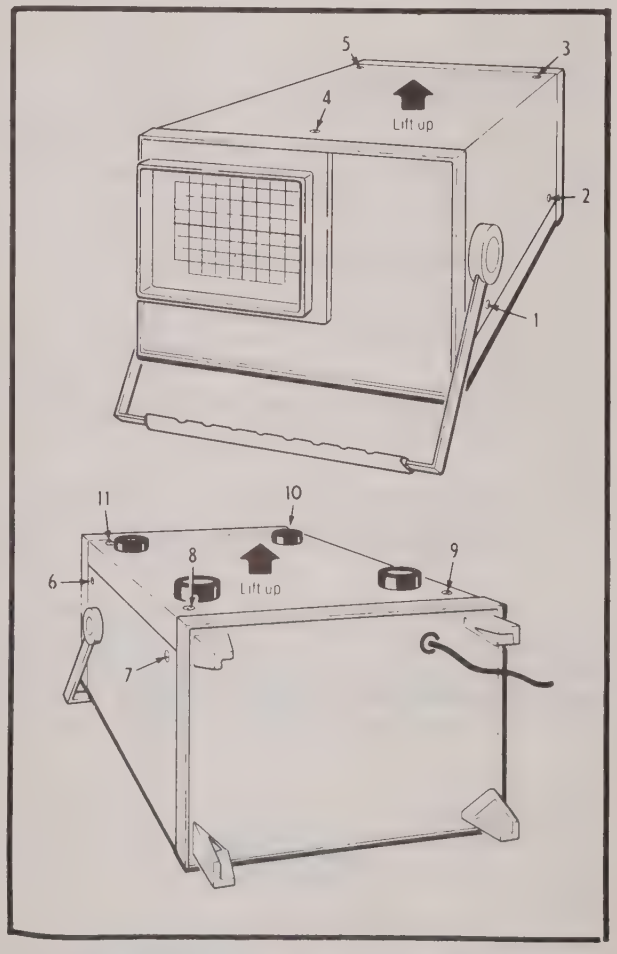


Fig. 15. Removing the Case.

A second fuse (F301), protecting the high voltage supply, is in series with the dc-dc converter. This fuse is located on the power supply circuit board. To replace fuse F301:

1. Remove the top section of the unit's case.

2. Locate and replace F301 on the power supply board (0.5 amp).

Blown fuses usually indicates a fault in the unit. The reason for blown fuses should be determined and corrected before replacing the fuse.

120/240 V CONVERSION

The oscilloscope will operate from either 120 or 240 VAC (50/60 Hz) power source. To adapt the scope to the power source:

1. Remove top section of case.

2. Locate and disconnect voltage selector plug from connector P5 (Fig. 16).

3. Rotate plug 180° and reinsert in P5 as shown in Fig. 16.

4. Replace fuse F1 with one of the appropriate value (0.7 amp for 120 V or 0.3 amp for 240 V).

The tapped power transformer may also be wired to operate from a 100 or 220 VAC power source. Refer to the schematic diagram and make corresponding wiring changes at connector P3 (adjacent to P5).

DISASSEMBLY

WARNING

Before attempting any major disassembly, disconnect the main power cord and discharge high voltage capacitors to prevent electrical shock.

Disassembly of this oscilloscope, including removal and replacement of the CRT and circuit boards, is illustrated in the MECHANICAL PARTS LIST section of this manual. Some disassembly may require removal of front panel knobs. Round control knobs are secured by set screws. Lever switch knobs just pull off and push on. Pushbutton knobs are secured by a flange behind the front panel, and cannot be removed until the front panel is removed (or the pushbutton switch assembly is removed from the front panel).

TROUBLESHOOTING

A complete set of troubleshooting charts follows, which should help isolate most faults. Always test the unit for functional operation and performance to specification after performing a repair.

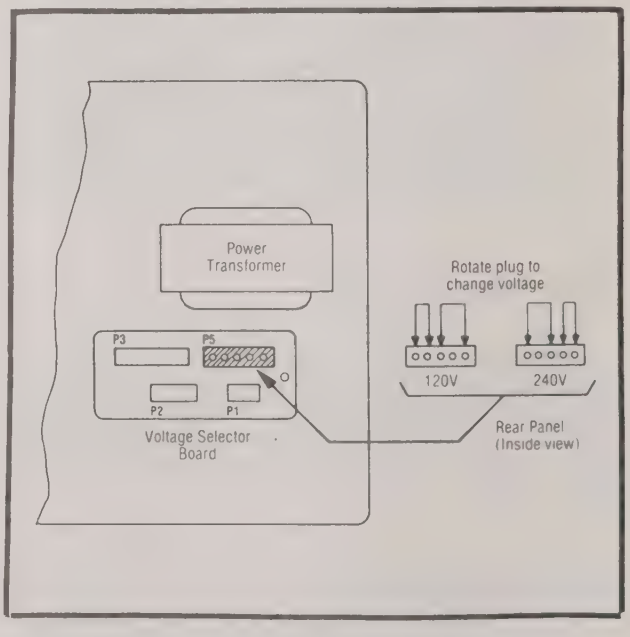
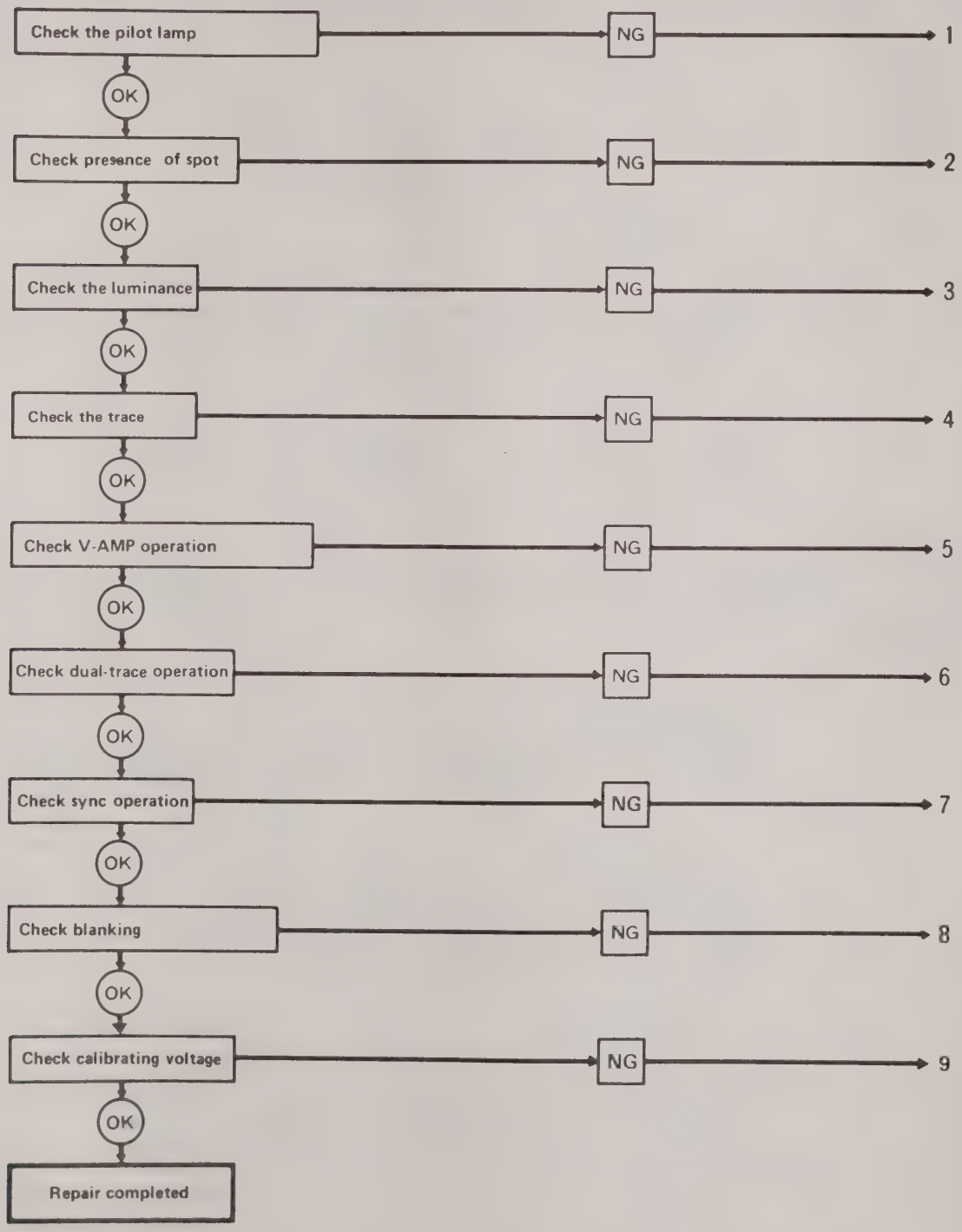
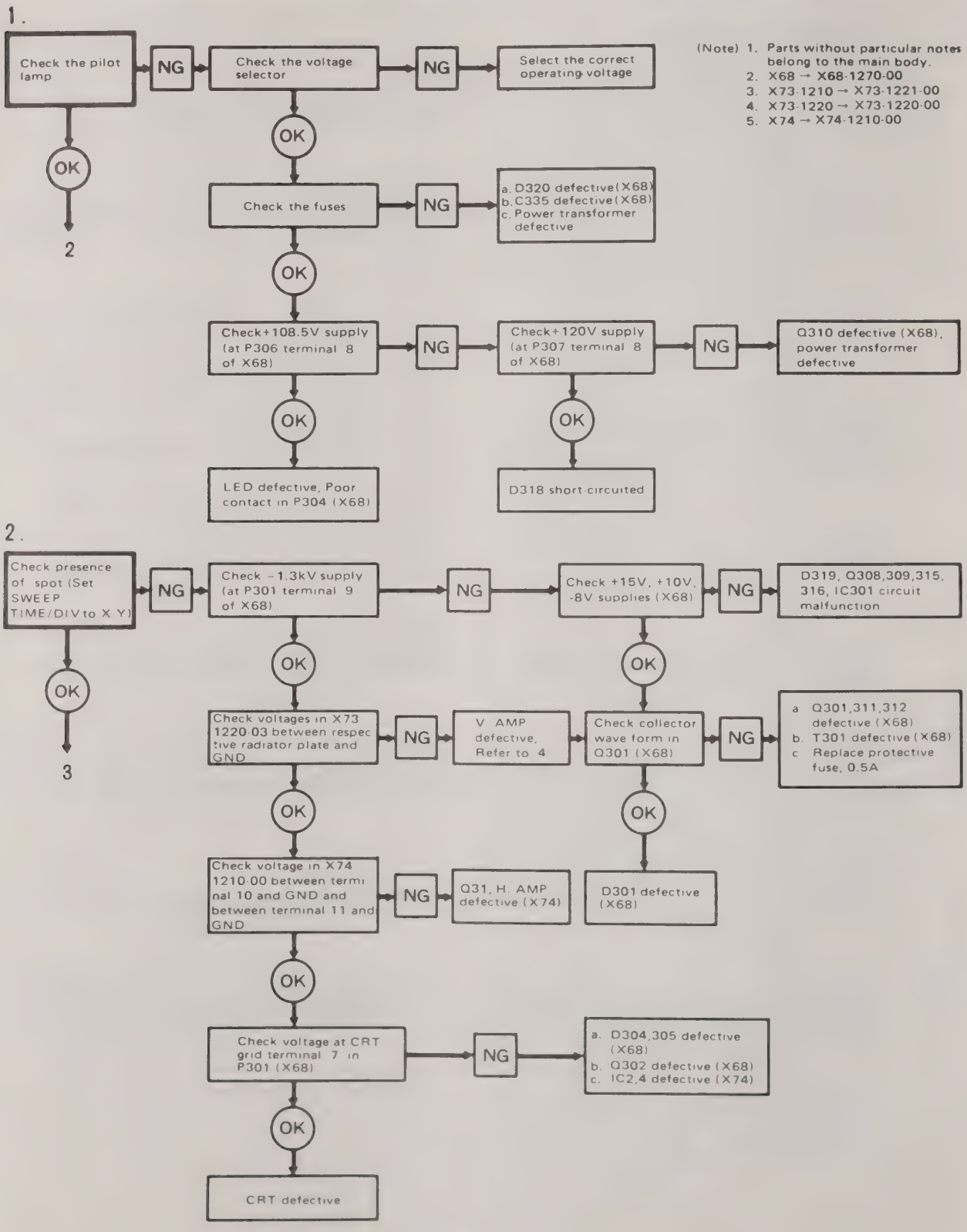


Fig. 16. 120/240 V Conversion.

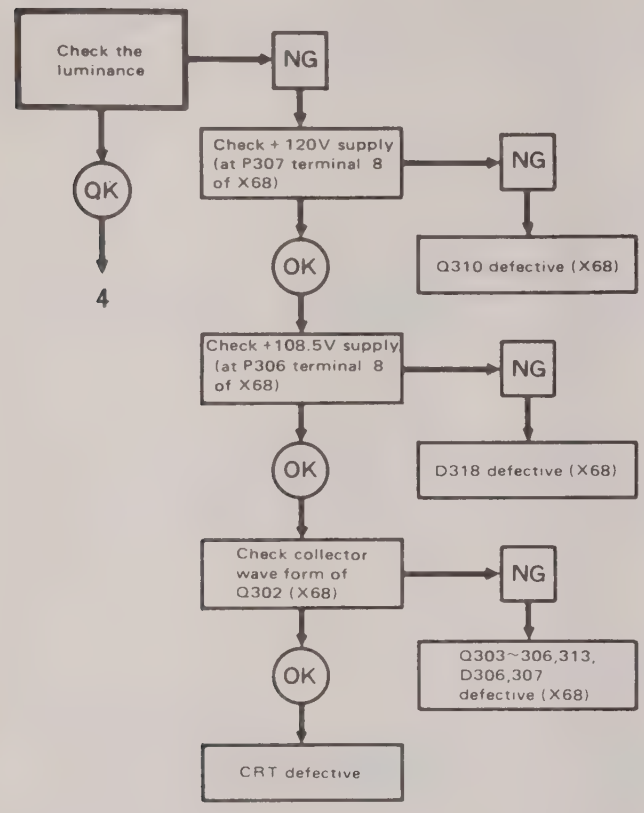
TROUBLESHOOTING CHART





(Note) 1. Parts without particular notes belong to the main body.
2. X68 → X68-1270-00
3. X73-1210 → X73-1221-00
4. X73-1220 → X73-1220-00
5. X74 → X74-1210-00

3.



4.

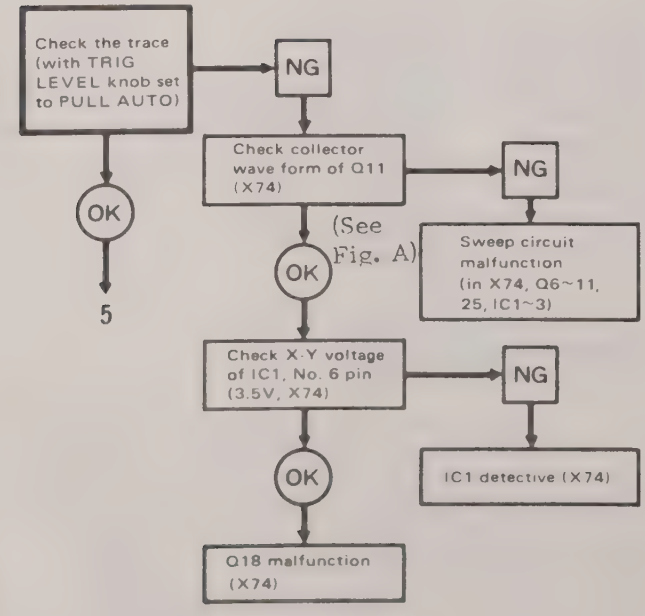
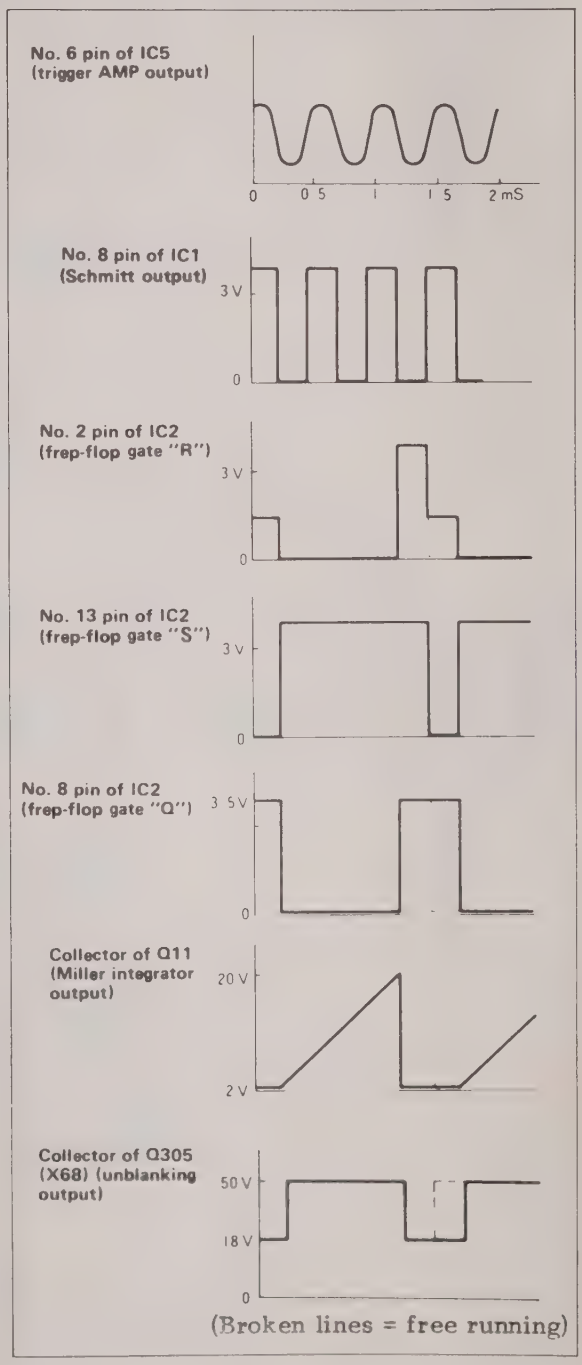
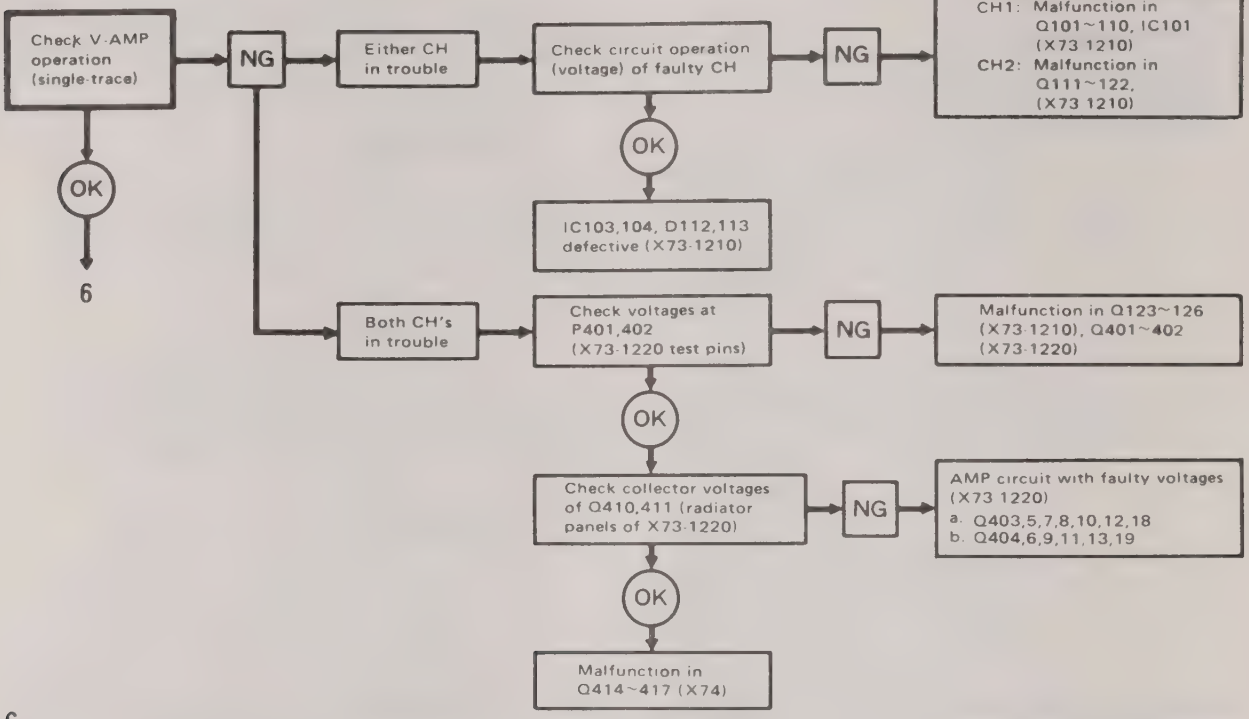


Fig. A. Waveform in Sweep Circuit (Input 2 kHz sine wave, Sweep Time 0.1 ms/div)



5.



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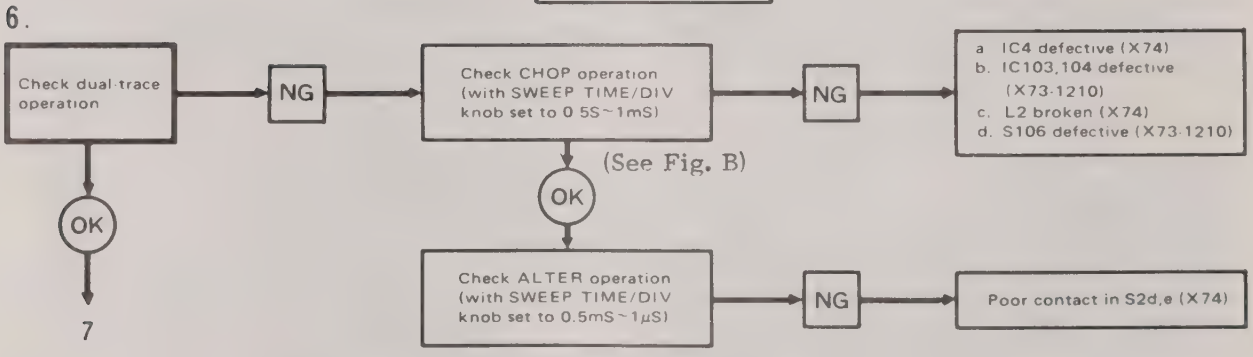


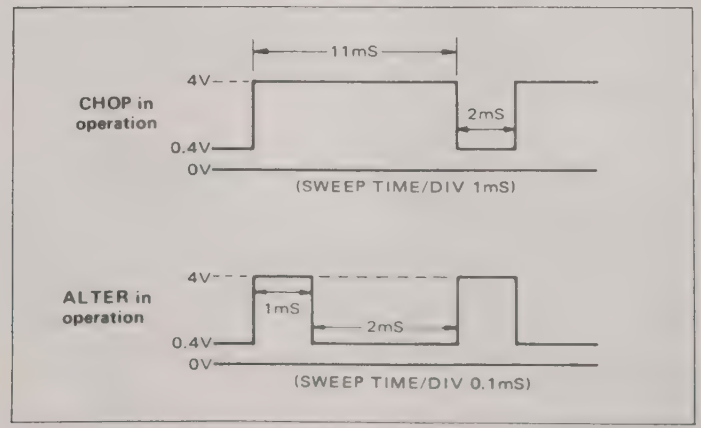
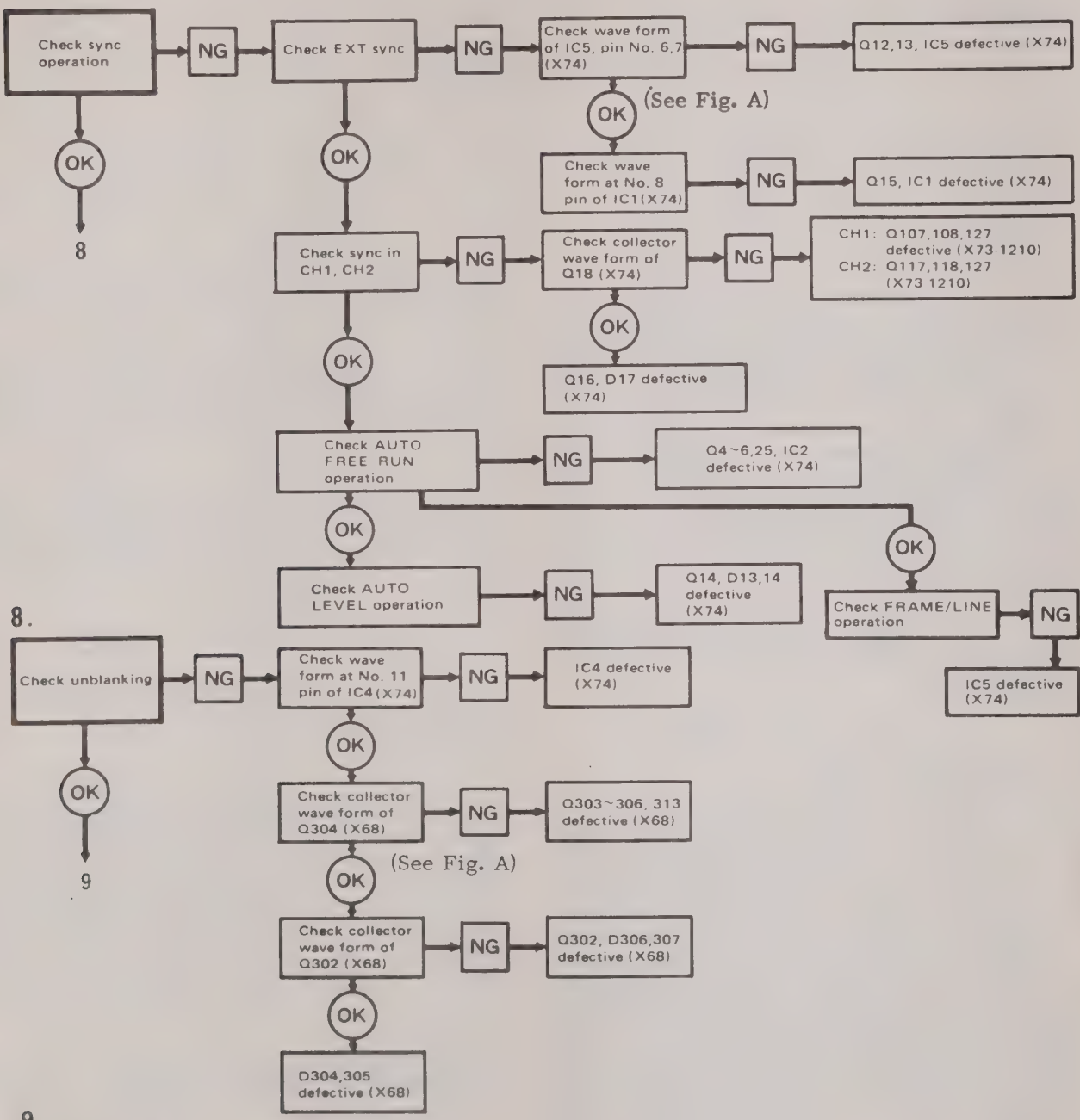


Fig. B. J1 Clock Pulse Waveforms at Terminal 5.

7.


Check sync operation
NG
Check EXT sync
NG
Check wave form of IC5, pin No. 6,7 (X74)
NG
Q12,13, IC5 defective (X74)
OK
(See Fig. A)
OK
8
OK
Check wave form at No. 8 pin of IC1(X74)
NG
Q15, IC1 defective (X74)
Check sync in CH1, CH2
NG
Check collector wave form of Q18 (X74)
NG
CH1: Q107,108,127 defective (X73-1210)
CH2: Q117,118,127 (X73 1210)
OK
OK
Q16, D17 defective (X74)
Check AUTO FREE RUN operation
NG
Q4~6,25, IC2 defective (X74)
OK
OK
Check AUTO LEVEL operation
NG
Q14, D13,14 defective (X74)
Check FRAME/LINE operation
NG
IC5 defective (X74)
8.
Check unblanking
NG
Check wave form at No. 11 pin of IC4(X74)
NG
IC4 defective (X74)
OK
OK
9
Check collector wave form of Q304 (X68)
NG
Q303~306, 313 defective (X68)
(See Fig. A)
OK
Check collector wave form of Q302 (X68)
NG
Q302, D306,307 defective (X68)
OK
D304,305 defective (X68)
9.
Check wave form of calibrating voltage
NG
Q1~3, D1 defective (X68)
OK
Repair completed

CALIBRATION

GENERAL

This oscilloscope was calibrated at the factory before shipment. Readjustment is recommended only if repairs have been made in a circuit affecting calibration or if you have reason to believe the unit is out of calibration. Complete calibration procedures are given in this manual. However, calibration adjustments should be attempted only if the proper test equipment is available, and you are experienced and qualified in its use. If the the test equipment used for calibration is less accurate than specified, the accuracy of the oscilloscope will be proportionately degraded. Perform related adjustments only in the specified sequence to prevent undesirable interaction of adjustments.

CALIBRATION CHECK

A general check of calibration accuracy may be made by displaying the output of the CAL 1kHz ⎍⎍ 0.5V p-p terminal on the screen of the oscilloscope. This test signal provides a square wave of 0.5 volt peak-to-peak ±3%, and period of 1 millisecond ±3%. This signal may be used for probe compensation adjustment and for an approximate check of amplitude and time accuracy. However, the CAL signal should never be used for performing recalibration adjustments; a signal source with amplitude and time accuracy of 0.5% or better should be used for performing calibration adjustments.

TEST EQUIPMENT REQUIRED

The following items of test equipment are recommended for calibration of the Model 1474, 1479, 1479A or 1479B Oscilloscopes.

DC Voltmeter. 1% or better accuracy in the 100 mV to 200 V range (**B & K-Precision** Model 2815 or 2831 or equivalent).

High Voltage Multiplier Probe. 3% or better accuracy at 1.5 kV. Input impedance 100 megohms or greater (**B & K-Precision** Model PR-28 or equivalent).

Sine and Square Wave Generator. 100 Hz to 100 kHz range. Amplitude variable from 10 mV to 10 V peak-to-peak. Sine wave distortion 1% or less (**B & K-Precision** Model 3010, 3020, 3025, or 3030).

Fabricated RF Oscillator (Fig. 18).

Frequency Counter. 0.5% or better accuracy. 10 Hz to 10 MHz range (Any **B & K-Precision** frequency counter).

Oscilloscope Calibrator. Amplitude accuracy of 0.5% or better at 1 kHz at peak-to-peak amplitude of 50 mV, 0.5 V, 5 V and 10 V. Time marker accuracy of 0.5% or better at periods of 1 ms, 20 µs, 0.5 µs, and 0.2 µs. Pulse rise time 4 ns or less (Zi-Tech 303, Ballantine Model 6125, or Tektronix Model PG-506 Calibration generator, PG-501 Time Mark Generator and TM-500 Series Mainframe, or equivalent).

Sweep Generator. At least 1 kHz to 30 MHz sweep. Amplitude flatness to 30 MHz within ±3%. Frequency markers every 5 MHz.

PRELIMINARY PROCEDURE

Make sure that the line voltage is within 105-130 VAC for 120 volt operation or within 210-260 VAC for 240 volt operation. Warm up the oscilloscope and the calibrating instruments thoroughly (30 minutes) before starting.

Before starting adjustments, set operating controls as specified in Table 1. Each procedure assumes the operating controls to be in this initial condition and instructs any changes required.

NAME OF KNOB	POSITION
INTENSITY	3 o'clock
FOCUS	optimum position
MODE	CH A
V POSITION (CH A and B)	mechanical center
VOLTS/DIV (CH A and B)	5 mV/div
VARIABLE (CH A and B)	CAL
AC-GND-DC (CH A and B)	DC (GND for no input signal)
CH B POLARITY	NORM
SOURCE	CH A
COUPLING	AC
SLOPE	"+"
TRIG LEVEL	mechanical center
PULL AUTO	pulled out
FIX/NORM	NORM
SWEEP TIME/DIV	1 ms/div
SWEEP VARIABLE	CAL
H POSITION	mechanical center
PULL X5 MAG	pushed in
VIDEO/NORM	NORM

Table 1. Initial Control Settings for Calibration Adjustments.

POWER SUPPLY ADJUSTMENTS

Low Voltage Adjustment and Power Supply Voltage Checks

1. Connect a dc voltmeter to measure the voltage at P306, pin 8 with respect to chassis ground.

2. Adjust VR304 to +108.5 V ±1% for Model 1479B, or to +107 V ±1% for Models 1474, 1479, and 1479A.

3. Connect a dc voltmeter to measure the voltage at each of the points listed in Table 2 with respect to chassis ground. Voltage readings should also be approximately as listed in Table 2.

MEASURE	VOLTAGE
P306, pin 2	-8 V
P306, pin 3	+5 V
P306, pin 4	+15 V
P306, pin 5	+10 V
P307, pin 8	+120 V *

* = +124 V for Model 1479B

Table 2. Power Supply Checks.

High Voltage Adjustment

1. Connect a dc voltmeter with high voltage, high impedance probe (at least 100 Megohms impedance) to P301 pin 9.

2. Adjust VR303 to obtain -1.5 kV for Model 1479B, or -1.9 kV for Models 1474, 1479, or 1479A.

INTENSITY AND DISPLAY ADJUSTMENTS

FOCUS and ASTIGmatism Adjustment

Adjust the focus and astigmatism as outlined in the OPERATOR MAINTENANCE section.

Intensity Theshold Adjustment

1. Set the LEVEL control to the AUTO position (out) to obtain a sweep.

2. Adjust VR302 so the trace just disappears as the INTENSITY control is reduced to the 10 o'clock position.

Blanking Adjustment

1. Set SWEEP TIME/DIV control to 0.2 µs (fastest speed). The LEVEL switch must pulled (AUTO position) to obtain trace.

2. Use the minimum INTENSITY setting that will produce a visible trace. With the correct setting, some of the trace will be visible, but the beginning of the trace will not appear.

3. Adjust TC301 to unblank the trace at the earliest possible point; i.e., so the trace becomes visible as far to the left as possible.

Pattern Distortion

This adjustment does not apply to Model 1479B.

1. Select X-Y operation (set SWEEP TIME/DIV switch to CH B).

2. Apply a 1 kHz sine wave to the CH A input and a 100 Hz sine wave to the CH B input.

3. Adjust amplitudes of the 1 kHz and 100 Hz inputs (and/or CH A and CH B attenuators) for approximate 8 X 8 division display.

4. The ideal display is shown in Fig. 17. If the display is similar to (a) or (b), adjust VR301 to achieve pattern (c).

5. Readjust FOCUS and ASTIGMATISM if required.

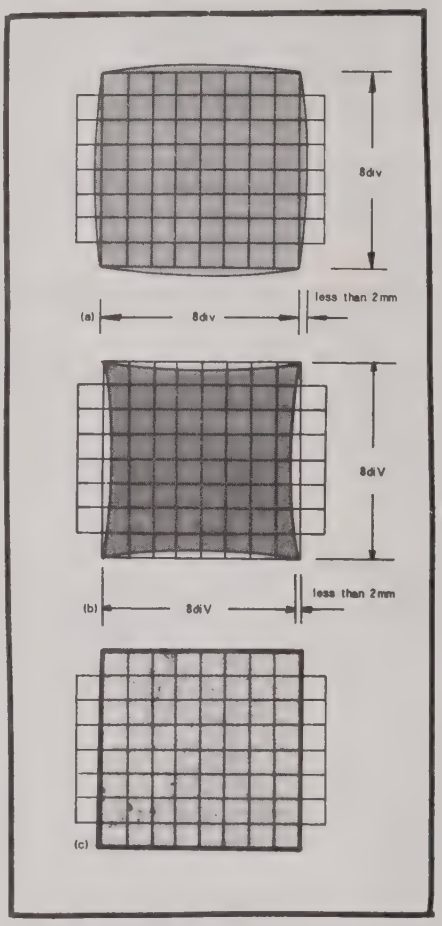


Fig. 17. Pattern Adjustment.

VERTICAL AXIS ADJUSTMENTS

Vertical Centering

The first vertical axis adjustment is to establish dc balance in the vertical output amplifier. This is accomplished by shorting the input of the output amplifier to eliminate any residual unbalance from the preamplifier section, and adjusting for a vertically centered trace.

1. Short P401 to P402 on vertical amplifier board.

2. Adjust VR402 to center trace vertically.

3. Remove short from step 1.

DC Balance

Adjust the DC balance as specified in the OPERATOR MAINTENANCE section.

Channel B Polarity and Position Adjustments

1. Set Channel A and Channel B AC-GND-DC switches to GND position.

2. Set MODE switch to CH B. Select AUTO triggering to obtain trace.

3. Alternately select normal and inverted polarity with CH B POLARITY pushbutton switch. Adjust VR112 so CH B trace does not shift when CH B POLARITY switch is operated.

4. Select DUAL Mode.

5. Verify channel A and B POSITION controls are mechanically centered. Be sure to use center of mechanical rotation. If necessary, loosen knob set screw and reposition knob pointer to top (12 o'clock).

6. Adjust VR105 and VR402 to superimpose both traces in the center of screen.

Vertical Gain Adjustments

1. Set MODE switch to CH A.

2. Apply calibrated 20 mV p-p 1 kHz square wave to CH A input.

3. Set CH A VARIABLE control to CAL and VOLTS/DIV to 5 mV.

4. Adjust VR401 for exactly 4 divisions vertical amplitude.

5. Repeat the procedure for CH B, adjusting VR110.

Input Capacitance

The object of this procedure is to equalize the input capacitance for all sections of the vertical attenuator. This is accomplished by first using the non-adjustable capacitance of the input FETs on the non-attenuated range (5 mV/div) as reference, then trimming the input capacitor of each attenuator section to match. A measurement corresponding to the reference capacitance is established by connecting it as the tuning capacitor of a test oscillator (Fig. 18). This causes the test oscillator to operate at a reference frequency. The reference frequency is measured on a frequency counter. The specific frequency at which the test oscillator operates is not critical, but the frequency should be stable at approximately 5 MHz. The attenuator is then switched to other ranges. For each attenuator section, the associcated trimmer capacitor is adjusted so the test oscillator again operates at the reference frequency. A non-metallic tool should be used for adjusting trimmers.

1. Build the test oscillator shown in Fig. 18 and connect it to the frequency counter and the CH A input of the oscilloscope as shown. No input signal is applied during this procedure

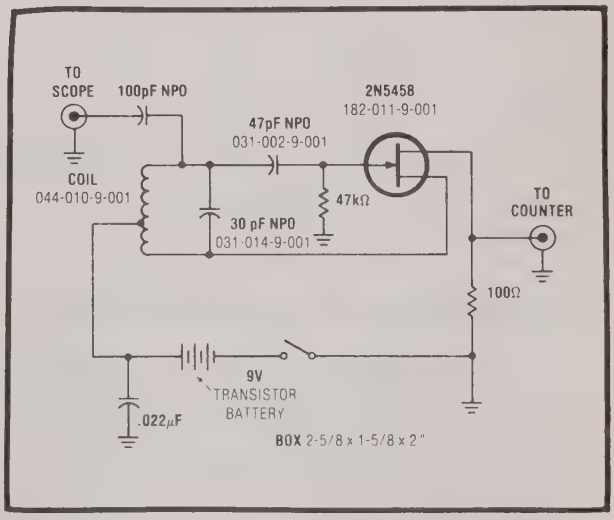


Fig. 18. Schematic of Test Oscillator for Input Capacitance Adjustment.

2. Turn on the oscilloscope to stabilize the input capacitance of the input FET amplifier.

3. Set CH A VOLTS/DIV control to 5 mV.

4. Measure and record reference frequency of test oscillator on frequency counter.

5. Set CH A VOLTS/DIV control to other ranges and adjust corresponding trimmer to match reference frequency recorded in step 4, as listed in Table 3.

6. Connect test oscillator to CH B INPUT and repeat adjustments for CH B as listed in Table 4.

CH A VOLTS/DIV	ADJUST
5 mV	reference
50 mV	TC102
0.5 V	TC104
5 V	TC111

Table 3. CH A Input Capacitance Adjustments

CH B VOLTS/DIV	ADJUST
5 mV	reference
50 mV	TC107
0.5 V	TC109
5 V	TC112

Table 4. CH B Input Capacitance Adjustments.

Input Capacitance, Alternate Method

An alternate method of adjusting input capacitance, although not as accurate as the previous method, may be used if the test oscillator of Fig. 18 is not available. This method requires the simpler network shown in Fig. 19. This network is essentially a 2:1 probe, since the 1 MΩ resistance of the network and the 1 MΩ input resistance of the vertical attenuator form a voltage divider. A 10:1 probe could also be used, except that a square wave of at least 100 volts p-p (not commonly available) would be required for adjustment of the 5 V/div attenuator setting.

1. Connect the network of Fig. 19 between a square wave generator and the CH A INPUT of the oscilloscope.

2. Set the CH A VOLTS/DIV control to 5 mV and apply sufficient 1 kHz square wave for 5 divisions amplitude. Set sweep time for one or two cycles of displayed square wave.

3. Adjust the external trimmer for the ideal square wave characteristic per Fig. 20. This is the reference square wave. The external trimmer should not be readjusted after this step.

4. In turn, set the CH A VOLTS/DIV control to 50 mV, 0.5 V, and 5 V ranges. At each setting, increase the square wave generator output to display a square wave of 2 to 5 divisions amplitude. Adjust the corresponding internal trimmer (see Table 3) to match reference square wave characteristic displayed in step 3.

5. Repeat adjustments for CH B, adjusting the trimmers listed in Table 4.

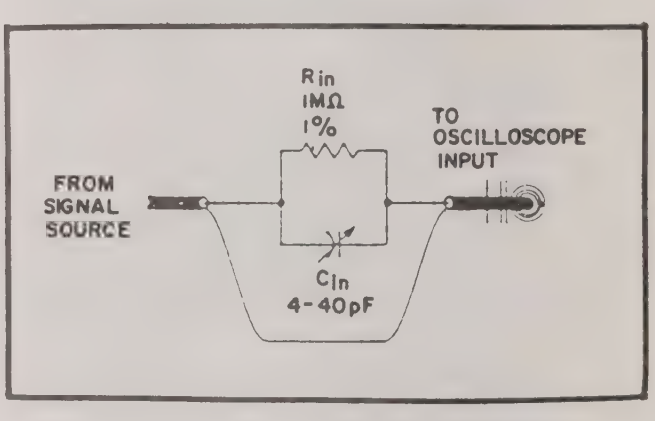


Fig. 19. Network for Alternate Input Capacitance Adjustment.

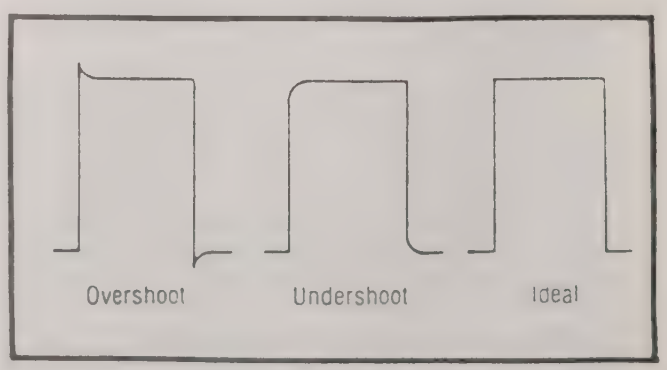


Fig. 20. Adjusting 1 kHz Square Wave Characteristic.

Vertical Attenuator Frequency Compensation

The purpose of this procedure is to equalize frequency compensation trimmers for all sections of the vertical attenuator. This is accomplished by first applying a 1 kHz square wave in an unattenuated range (5 mV/div) and using the displayed waveform for reference. The vertical attenuator is then switched to other ranges and the corresponding trimmer adjusted to obtain the same square wave characteristics as the reference waveform.

This procedure must be performed after the "Input Capacitance" adjustments.

1. Set CH A VOLT/DIV control to 5 mV and apply 1 kHz square wave signal. Adjust signal generator level to 20 mV p-p, which should give a square wave display of 4 divisions amplitude. Set sweep time to display one or two cycles of square wave signal.

2. Observe square wave characteristics for reference. See Fig. 20 for desired waveshape.

3. In turn, set the CH A VOLTS/DIV control to 50 mV, 0.5 V, and 5 V ranges. At each setting, increase the square wave generator output as listed in Table 5. This will display a square wave of 2 to 4 divisions amplitude. Adjust the corresponding trimmer listed in Table 5 to match the reference square wave characteristic displayed in step 2.

4. Repeat adjustments for CH B, adjusting the trimmers listed in Table 6.

CH A VOLTS/DIV	INPUT	ADJUST
5 mV	20 mV p-p	Reference
50 mV	200 mV p-p	TC101
0.5 V	2 V p-p	TC103
5 V	10 V p-p	TC105

Table 5. CH A Vertical Attenuator Frequency Compensation Adjustments.

CH B VOLTS/DIV	INPUT	ADJUST
5 mV	20 mV p-p	Reference
50 mV	200 mV p-p	TC106
0.5 V	2 V p-p	TC108
5 V	10 V p-p	TC110

Table 6. CH B Vertical Attenuator Frequency Compensation Adjustments.

Vertical Amplifier Frequency Compensation

These adjustments of the vertical output amplifier extend the -3 dB bandwidth to at least 30 MHz. Proper adjustment is critical to accuracy and non-distorted display at high frequencies. The best results can be obtained by alternately using a combination of two methods. The first is by observing the leading edge of a 100 kHz square wave and adjusting for best waveshape. The second is by observing the frequency response display using a sweep generator with a flat response from 1 kHz to at least 30 MHz. Since all adjustments interact to some degree, it is advisable to repeat the procedure until no improvement can be obtained, typically three times.

1. Set MODE and SOURCE switches to CH B and CH B VOLTS/DIV to 5 mV.

2. Apply 100 kHz square wave with fast rise time to CH B input. The square wave must be terminated into 50 ohms.

3. Adjust square wave amplitude for 6 divisions of amplitude.

4. Rotate SWEEP TIME/DIV control from 2 µs to 0.2 µs, observing the leading edge of the square wave as in Fig. 21. Make adjustments in the sequence listed in Table 7 for best overall square wave characteristic. Overshoot must be less than 3% (0.2 division). However, do not eliminate all overshoot as high frequency response will be degraded.

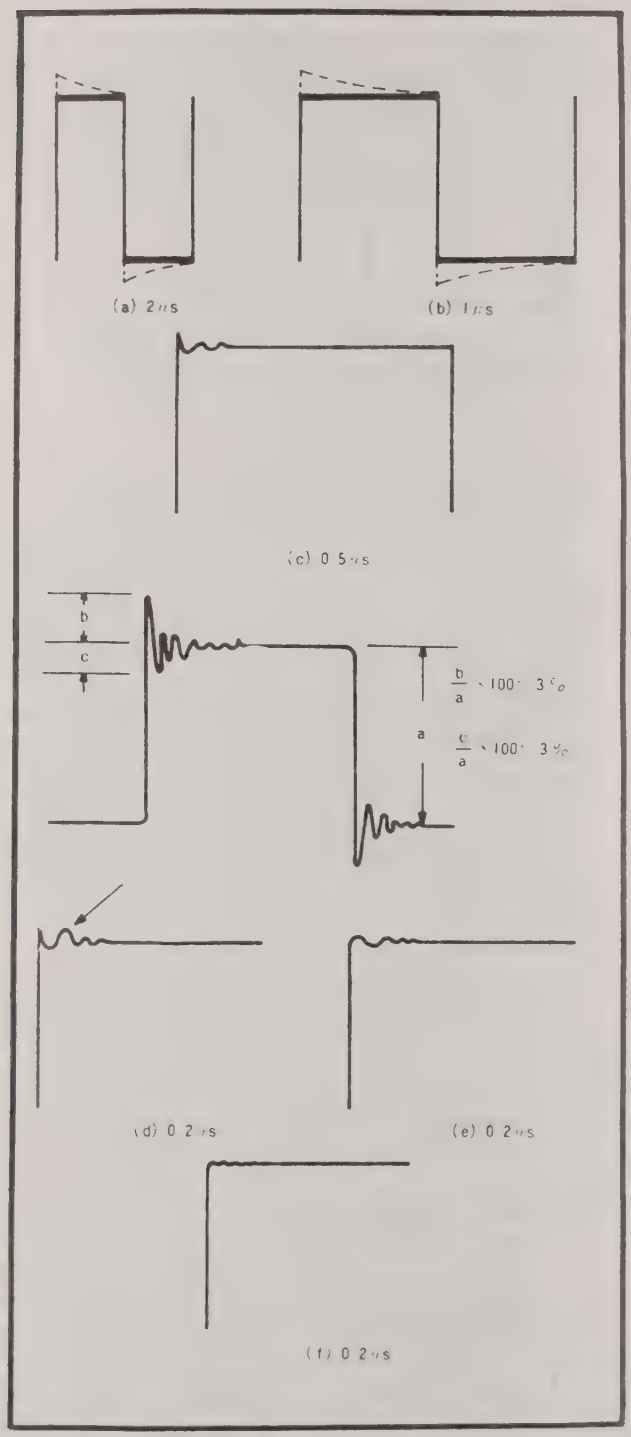


Fig. 21. Vertical Amplifier Frequency Compensation Adjustment.

SWEEP TIME	ADJUST	FUNCTION
2 µs/div	TC403	Mid-Freq
2 µs/div	VR404	Mid-Freq
1 µs/div	TC401	Hi-Freq
1 µs/div	VR403	Hi-Freq
0.5 µs/div	TC402	Hi-Freq
0.2 µs/div	TC404	Hi-Freq
0.2 µs/div	VR405	Hi-Freq

Table 7. Vertical Amplifier Frequency Compensation Adjustment Sequence.

5. Disconnect 100 kHz square wave generator and connect rf output of sweep generator to CH B input. Set generator to sweep from 1 kHz to at least 30 MHz with frequency markers each 5 MHz. A display similar to Fig. 22 should be displayed. Set sweep generator level for 6 divisions amplitude at lower frequencies. Repeat adjustments of step 4 for smooth roll off at higher frequencies and amplitude of at least 4.2 divisions (-3 dB) at 30 MHz.

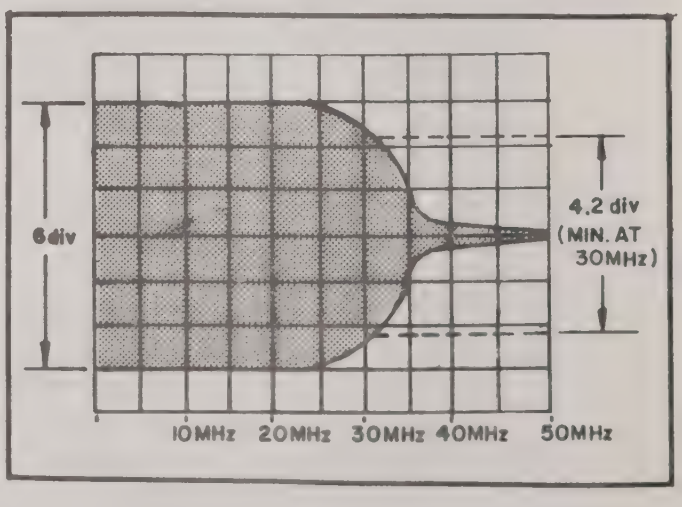


Fig. 22. Frequency Response Display.

6. Repeat procedure if needed for optimum waveform and frequency response curve.

7. Switch to dual-trace mode and simultaneously apply sweep generator signal to both CH A and CH B. Use CH A and CH B POSITION controls to superimpose frequency response curves. Adjust TC113 so channel A response curve most closely matches channel B.

Final Vertical Adjustment

Repeat "DC Balance" adjustments for channel A and B. This is a very important step that must be performed before "Triggering Adjustments".

HORIZONTAL AXIS ADJUSTMENTS

Sweep Time and Sweep Length

1. Set SWEEP TIME/DIV control to 1 ms and apply 1 ms marker signal to CH A.

2. Apply 1 ms time mark (±0.5%) or 1 kHz square wave (±0.5%).

3. Adjust VR15 so 10 marks exactly occupy 9 divisions as shown in Fig. 23 (first mark may not be visible).

4. Adjust VR6 for total sweep length to approximately 10.5 divisions (Fig. 23).

1 µs, 0.5 µs and 0.2 µs Sweep Time Adjustments

1. Set SWEEP TIME/DIV control to 1 µs, 0.5 µs, and 0.2 µs while applying the corresponding marker signal (see Table 8) to display 11 waves on the CRT screen.

2. Adjust TC1, TC2, and VR5 so that the 11 markers occupy exactly 10 divisions (Fig. 23). The first marker may not be visible.

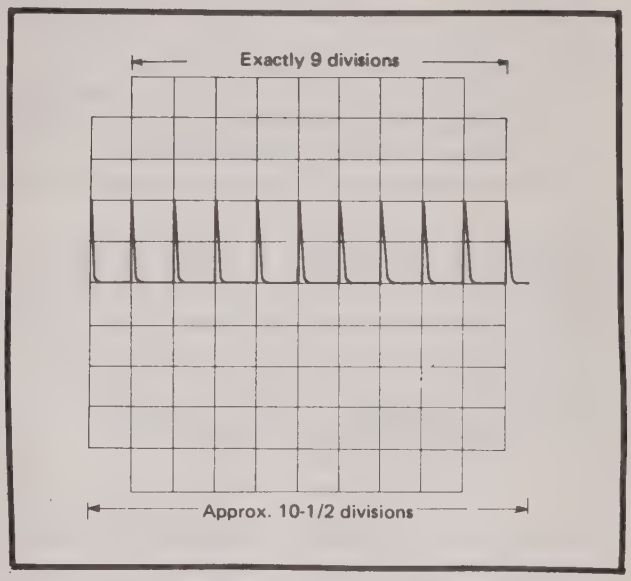


Fig. 23. Sweep Time and Sweep Length Adjustment.

SWEEP TIME	MARKER SIGNAL	ADJUST
1 ms/div	1 ms	VR15
1 µs/div	1 µs	TC1
0.5 µs/div	0.5 µs	TC2
0.2 µs/div	0.2 µs	VR5

Table 8. Sweep Time Adjustments.

Linearity Adjustment

Early Model 1474 does not include linearity adjustments TC3 and TC4.

1. Select 20 µs/div sweep time and 5X MAG. Apply 250 kHz sine wave at 6 divisions amplitude. Adjust TC3 for best linearity i.e., so each cycle has equal spacing (Fig. 24).

2. Set sweep time to 0.2 µs and apply 25 MHz sine wave at 2 divisions amplitude. Pull 5X MAG switch out and use horizontal POSITION control to start wave at left edge of scale. Adjust TC4 for best linearity (Fig. 24).

3. Linearity adjustments interact with sweep time calibration adjustments. Recheck sweep time calibration. If necessary, repeat sweep time and linearity adjustments to eliminate interaction.

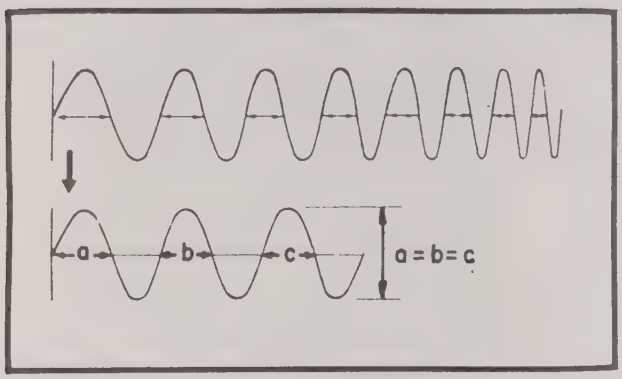


Fig. 24. Linearity Adjustment.

Horizontal POSITION Adjustment

1. Set SWEEP TIME/DIV control to 0.2 ms and apply 1 ms marker signal to CH A to display three pulses on screen (Fig. 25).

2. Set horizontal POSITION control at mechanical center. Be sure to use the mechanical center of rotation. If necessary, loosen knob set screw and reposition knob pointer to top (12 o'clock) before adjustment. Adjust VR13 (Model 1474 and 1479) or VR16 (Model 1479A and 1479B) to center pulses on screen (Fig. 25).

X5 MAG Centering and Gain Adjustments

1. Set SWEEP TIME/DIV control to 1 ms and apply 1 ms marker signal to CH A input. Markers will be 1 division apart (Fig. 25).

2. Pull out the PULL 5X MAG knob and adjust VR14 (Model 1474 and 1479) or VR18 (Model 1479A and 1479B) so there are 5 divisions between marks (Fig 25).

3. With 1 ms markers still applied, set sweep time to 0.2 ms/div. Without 5X MAG there should be three markers displayed (Fig. 25). Set horizontal POSITION control so center marker is in center of screen.

4. Alternately push and pull PULL 5X MAG knob, being careful not to rotate the POSITION control. Adjust VR10 (Model 1474 and 1479) or VR17 (Model 1479A and 1479B) so center marker is at same point with X5 MAG on and off.

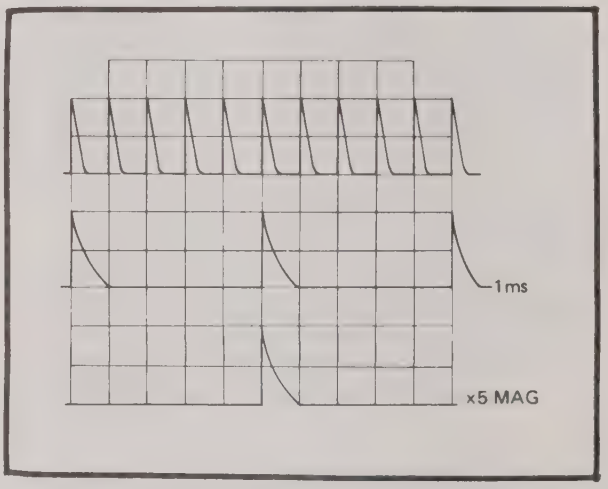


Fig. 25. X5 MAG Centering and Gain Adjustment.

X Position Adjustment

1. Set CH B position control to mechanical center (pointer to 12 o'clock).

2. Set channel AC-GND-DC switch to GND.
3. Select X-Y operation (SWEEP TIME/DIV to CH B). Turn down INTENSITY to prevent spot from burning tube.

4. Adjust VR12 (Model 1474 and 1479) or VR14 (Model 1479A and 1479B) to center spot on screen.

X Gain Adjustment

1. Set Channel B AC-GND-DC to AC, VOLTS/DIV to 5 mV, and VARIABLE to CAL.

2. Apply calibrated 20 mV p-p, 1 kHz square wave to channel B input.

3. Adjust VR111 to obtain 4 divisions of horizontal deflection (Fig. 26).

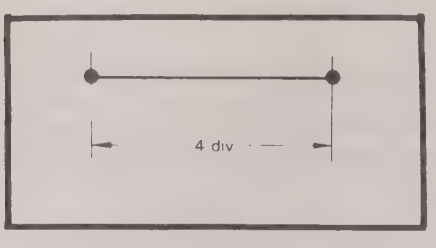


Fig. 26. Horizontal Gain Adjustment.

TRIGGERING ADJUSTMENTS

Off-Set Adjustment

1. Set LEVEL control to mechanical center. Be sure to use center of mechanical rotation. If necessary, loosen knob set screw and reposition knob pointer to top (12 o'clock).

2. Set VIDEO and FIX switches to NORM and COUPLING to AC.

3. Short IC5, pins 1 and 2 (P14 and P15 on Models 1474, 1479, and 1479A; P13 and P15 on Model 1479B).

4. Connect a calibrated oscilloscope to the wiper of SLOPE switch S5a (P13 on Models 1474, 1479, and 1479A; P14 on Model 1479B).

5. Alternately change SLOPE switch setting between (+) to (-) and adjust VR7 (Model 1474 and 1479) or VR10 (Model 1479A and 1479B) for minimum voltage change when switch is operated. This compensates for any dc offset in Schmitt trigger IC5.

Trigger Slope Balance

This procedure applies to Model 1474 and 1479 only.

1. Remove the short from IC5, pins 1 and 2 (from previous "Off-Set Adjustment").

2. Apply 1 kHz sine wave signal and adjust for 6 divisions amplitude on display.

3. With TRIG LEVEL control centered, alternately switch between (+) and (-) SLOPE. Adjust VR16 so starting point of waveform does not shift vertically when SLOPE switch position is changed.

TRIG LEVEL Center Adjustment

This procedure applies to Model 1479A and 1479B only.

1. Continue to monitor the voltage from SLOPE switch S5a (as in previous "Off-Set Adjustment" procedure).

2. TRIG LEVEL control must remain at its mechanical center (12 o'clock).

3. With no input signal applied (both AC-GND-DC switches set to GND), alternately connect and remove the short across IC5 input, pins 1 and 2. Adjust VR7 so voltage does not change when short across IC5 input is removed.

(+) and (-) Trigger Adjustment

This procedure applies to Model 1479A and 1479B only.

1. Set TRIG LEVEL control to its mechanical center (12 o'clock).

2. Apply 1 kHz sine wave to CH A to display 6 divisions of amplitude.

3. Set SLOPE to positive (+). Decrease waveform amplitude and adjust VR12 to trigger at less than 0.5 div amplitude as displayed on CRT.

4. Set SLOPE to negative (-) and adjust VR11 to trigger at less than 0.5 div amplitude as displayed on CRT.

5. Check that the starting point of the waveform does not shift when the SLOPE switch is changed between (+) to (-).

FIX Adjustment

This adjustment applies only to Model 1474, 1479, and early 1479A (Before Serial No. 99-09601)

1. Set FIX/NORM switch to FIX position.

2. Apply 1 kHz sine wave to CH A to display 6 divisions of amplitude.

3. Reduce signal level and adjust VR9 so signal will trigger below 0.5 div, and so starting point of waveform does not shift when SLOPE switch is changed from (+) to (-).

CH B DC Coupling Adjustment

1. Set MODE switch to CH B.

2. Apply 1 kHz sine wave at 6 div amplitude (input signal must not contain a dc component).

3. Using AC COUPLING, adjust TRIG LEVEL control so starting point of waveform does not change when SLOPE switch is changed between (+) and (-).

4. This step applies to Model 1474 and 1479 only. Adjust VR11 so starting point of waveform does not shift when COUPLING switch is changed between AC and DC.

5. This step applies to Model 1479A and 1479B only. Set VR19 to mechanical center. Adjust VR13 so starting point of waveform does not shift when COUPLING switch is changed between AC and DC. If VR13 reaches adjustment limit, alternately adjust VR19 and VR13.

CH A DC Coupling Adjustment

1. Set MODE switch to DUAL and COUPLING switch to DC.

2. Connect same 1 kHz sine wave to CH A and CH B inputs. Adjust for 6 div amplitude.
3. Adjust VR113 so starting point of waveform does shift when SOURCE switch is changed between CH A and CH B.

CAL SQUARE WAVE ADJUSTMENTS

1. Perform vertical axis and horizontal axis calibration before adjusting CAL square wave.

2. Connect CAL 1 kHz ⎍⎍ 0.5 V P-P terminal on front panel to CH B. Set SWEEP TIME/DIV to 0.1 ms/div and VOLTS/DIV to 0.1 V/div.

3. Adjust VR1 to display 0.5 volts peak-to-peak (5 divisions amplitude at 0.1 V/div sensitivity).

4. Adjust VR2 for 0.5 ms time period for the positive half of the square wave (5 divisions at 0.1 ms/div sweep time). Adjust VR3 for 0.5 ms time period for the negative half of the square wave. See Fig. 27.

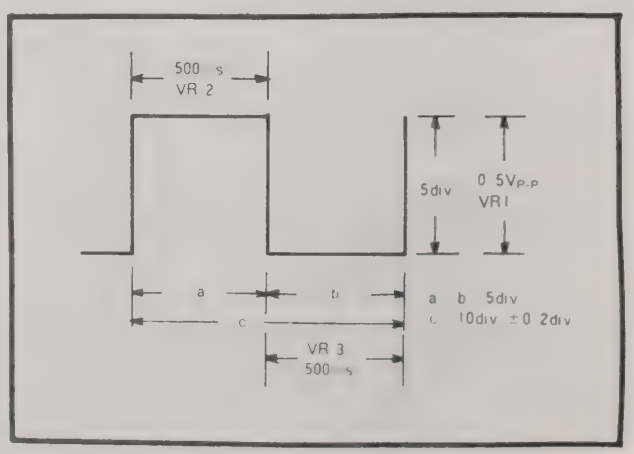


Fig. 27. CAL Square Wave Adjustment.

PERFORMANCE TESTS

Vertical and Horizontal Positioning

After calibration, the vertical and horizontal positioning is tested by operating the POSITION controls. The trace should move at least 4 divisions either side of the vertical center of the screen.

Rise Time

Rise time is the interval required for a pulse to rise from 10% to 90% level of transition. This oscilloscope is rated at a rise time of 11.7 ns or less. To check rise time use a signal with a rise time of 4 ns or less. Terminate the signal source in 50 Ωs to prevent ringing.

1. Apply a 4 ns or less rise time signal to CH A ipnut.
2. Set unit to its fastest sweep speed (0.2 μs/div, VARIABLE to CAL, and 5X MAG on). The sweep time is now 40 ns per division.
3. Adjust display to 6 divisions of amplitude.
4. Locate 10% and 90% amplitude points. The time (horizontal) between 10 and 90% should be 12 ns or less (3 mm) as shown is Fig. 28.
5. Repeat steps 1 thru 4 for channel B.

To measure oscilloscope rise time directly, the rise time of the input signal must be at least three times faster than that of the oscilloscope. The "observed" rise time is the cascaded rise times of the pulse and the oscilloscope's rise time.

The formula for calculating rise times is:

$$A = \sqrt{B^2 + C^2}$$

Where: A is observed rise time.

B is pulse rise time.

C is scope rise time.

The effect of the pulse's rise time is almost negligible if its rise time is at least three times faster than that of the oscilloscope being measured. The effect increases as the rise time approachs that of the scope. Never use a pulse with a rise time of 12 ns or more. If the input signal has a rise time of 4 ns or more the oscillosope's rise time can be calculated by:

$$C = \sqrt{A^2 - B^2}$$

Where: A is the observed rise time.

B is the pulse rise time.

C is the scope rise time.

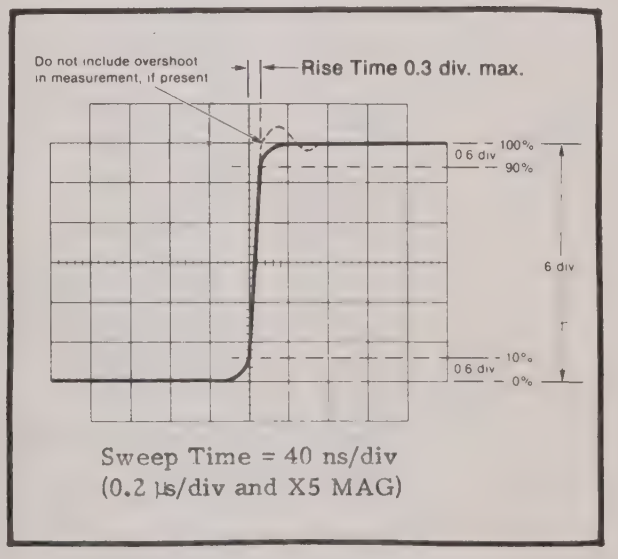


Fig. 28. Rise Time Measurement.

VERTICAL AMPLIFIER BOARD
(For Model 1474, 1479, 1479A, and 1479B)

VR101	CH A Vari. Atten Bal	TC103	CH A 100:1 Sq Wave Comp
VR103	CH A Step Atten Bal	TC104	CH A 100:1 Input Capacitance
VR105	CH A Vertical Position	TC105	CH A 250:1 Sq Wave Comp
VR106	CH B Vari. Atten Bal	TC106	CH B 10:1 Sq Wave Comp
VR108	CH B Step Atten Bal	TC107	CH B 10:1 Input Capacitance
VR110	CH B Gain	TC108	CH B 100:1 Sq Wave Comp
VR111	X-Gain	TC109	CH B 100:1 Input Capacitance
VR112	CH B Polarity Invert	TC110	CH B 250:1 Sq Wave Comp
VR113	CH A DC Trig Level	TC111	CH A 250:1 Input Capacitance
TC101	CH A 10:1 Sq Wave Comp	TC112	CH B 250:1 Input Capacitance
TC102	CH A 10:1 Input Capacitance	TC113	CH A High Frequency

VERTICAL OUTPUT AMPLIFIER BOARD
(For Model 1474, 1479, 1479A and 1479B)

VR401	CH A Gain	VR405	High Freq Response
VR402	CRT Vertical Centering (CH B Position)	TC401	High Freq Response
		TC402	High Freq Response
VR403	High Freq Response	TC403	Mid Freq Response
VR404	Mid Freq Response	TC404	High Freq Response

HORIZONTAL SWEEP BOARD
(For Model 1474 and 1479)

VR 1	CAL Amplitude
VR 2	CAL 0V Period
VR 3	CAL 0.5V Period
VR 5	0.2 µs Sweep Time
VR 6	Sweep Length
VR 7	Offset
VR 9	FIX Level
VR10	X5 MAG Center
VR11	DC Trigger Level
VR12	X Position
VR13	Horizontal Position
VR14	X5 MAG Gain
VR15	Sweep Time (1 ms)
VR16	Trigger Slope Balance
TC 1	1 µs-50 µs Sweep Time
TC 2	0.5 µs Sweep Time
TC 3	1 µs-50 µs Sweep Linearity (not on early 1474)
TC 4	0.5 µs Sweep Linearity (not on early 1474)

HORIZONTAL SWEEP BOARD
(For Model 1479A and 1479B)

VR 1	CAL Amplitude
VR 2	CAL 0V Period
VR 3	CAL 0.5V Period
VR 5	0.2 µs Sweep Time
VR 6	Sweep Length
VR 7	Trigger Level Centering
VR 9	FIX Level (early 1479A only)
VR10	Offset
VR11	(-) SLOPE
VR12	(+) SLOPE
VR13	DC Trigger Level
VR14	X-Position
VR15	Sweep Time (1 ms)
VR16	Horizontal Position
VR17	X5 MAG Centering
VR18	X5 MAG Gain
VR19	CH B DC Coupling Level
TC 1	1 µs-50 µs Sweep Time
TC 2	0.5 µs Sweep Time
TC 3	1 µs-50 µs Sweep Linearity
TC 4	0.5 µs Sweep Linearity

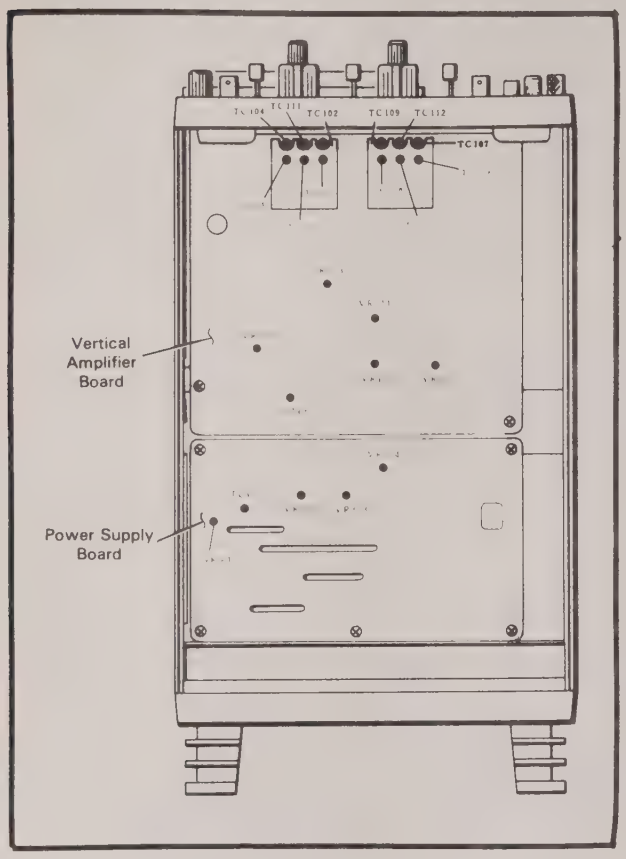
POWER SUPPLY BOARD
(for Model 1474, 1479, and 1479A)

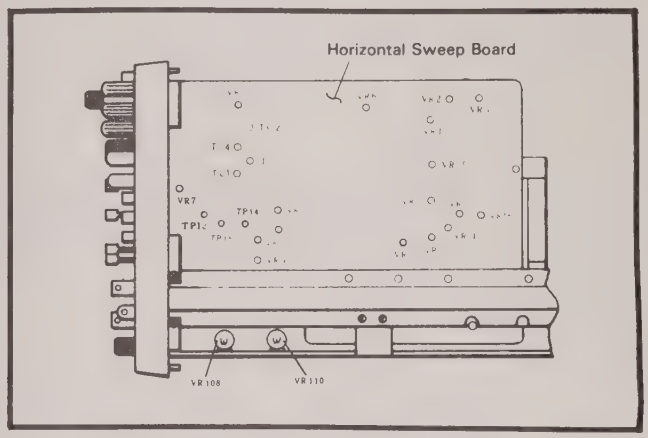
VR301	Pattern Distortion
VR302	INTENSITY Threshold
VR303	-1.9 kV Adj.
VR304	+107 V Adj.
TC301	Blanking

POWER SUPPLY BOARD
(for Model 1479B)

VR302	INTENSITY Threshold
VR303	-1.5 kV Adj.
VR304	+108.5 V Adj.
TC301	Blanking

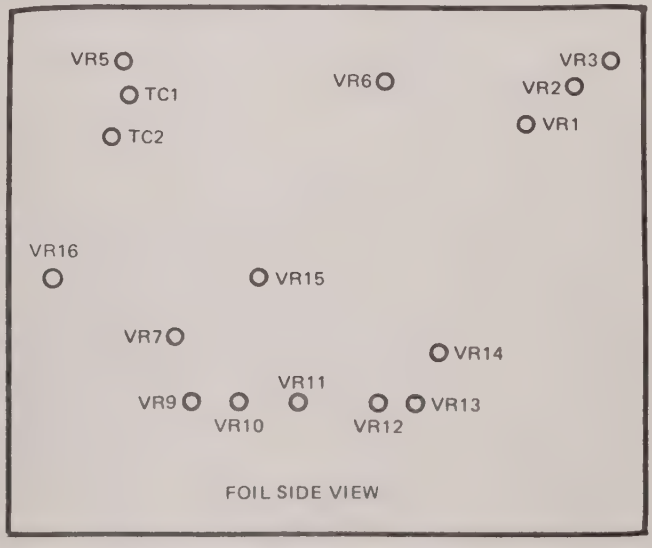
Table 9. Functions of Adjustments.





For Model 1479A and 1479B

Horizontal Sweep Board



For Model 1474 and 1479

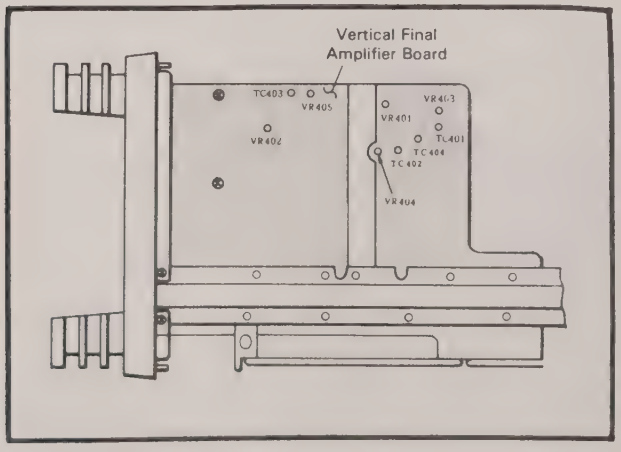


Fig. 29. Locations of Calibration Adjustments.

PARTS LIST

This section includes exploded views of the oscilloscope with accompanying mechanical parts list, a packing drawing with accompanying parts list, and an electrical parts list referenced to the schematic diagrams.

U.S.A. PARTS ORDERING INFORMATION

There is a minimum charge for each invoice. Orders will be shipped C.O.D. unless previous open account arrangements have been made or remittance accompanies order. Advance remittance must cover handling, postage or express charges. Specify model and serial number when ordering replacement parts.

ORDER REPLACEMENT PARTS FROM:

B & K-Precision, Dynascan Corporation
Factory Service Operations
4050 North Ravenswood Avenue
Chicago, Illinois 60613
Tel (312) 327-7270
Telex: 25-3475

INDEX NUMBER	DESCRIPTION	B & K-PRECISION PART NUMBER	1	2	3	4
	Parts List for Fig. 30.					
1	Trace Rotation Control (VR206)	008-267-9-003				X
2	ASTIG Variable Resistor (VR209)	008-226-9-005	X	X	X	X
3	Push Switch (NORM/FIX)	088-032-9-001	X	X	X	X
4	Frame	254-029-9-001	X			
4	Frame	254-039-9-001		X	X	X
5	Bracket	251-192-9-006	X			
5	Bracket	251-420-9-001		X	X	X
6	Lever Switch (S106)	080-004-9-002	X	X	X	X
7	Rotary Switch (S103, S104)	083-212-9-001	X	X	X	
7	Rotary Switch (S103, S104)	083-266-9-001				X
8	Lever Switch (S101, S102)	080-003-9-001	X	X	X	X
9	Position Control (VR104, VR109)	008-298-9-003	X	X	X	X
10	Variable Resistor	008-298-9-002	X	X	X	X
11	Focus Control (VR205)	008-235-9-001	X	X	X	X
12	Intensity Control (VR201)	008-267-9-002	X	X	X	X
13	Vertical Amplifier Board	523-177-9-002	X	X	X	X
14	Power Supply Board	523-177-9-005	X	X	X	
14	Power Supply Board	523-432-9-001				X
15	Shield Case	256-064-9-004	X			
15	Shield Case	256-120-9-001		X	X	
15	Shield Case	256-158-9-002				X
17	Horizontal Sweep Board	523-177-9-004	X			
17	Horizontal Sweep Board	523-277-9-001		X		
17	Horizontal Sweep Board	523-298-9-001			X	X
18	Variable Resistor (VR4)	008-298-9-006			X	X
19	Rotary Switch (S2)	083-212-9-002	X	X	X	X
20	Variable Resistor (VR8)	008-298-9-007	X			
20	Variable Resistor (VR8)	008-381-9-001		X	X	X
21	Lever Switch (S3, S4)	080-004-9-002	X	X	X	X
22	Lever Switch (S5)	080-004-9-001	X	X	X	X
23	Variable Resistor (VR204)	008-298-9-005	X	X	X	
23	Power Switch	083-268-9-001				X
24	Push Switch (S202)	088-061-9-001			X	X
25	Push Switch (S203)	088-032-9-002			X	
25	Push Switch (S203)	088-061-9-001				X
26	Variable Resistor (VR202)	008-226-9-002	X	X	X	X
27	Pilot Light (D201)	400-065-9-001		X	X	X

Code: 1 = Model 1474, 2 = Model 1479, 3 = Model 1479A, 4 = Model 1479B

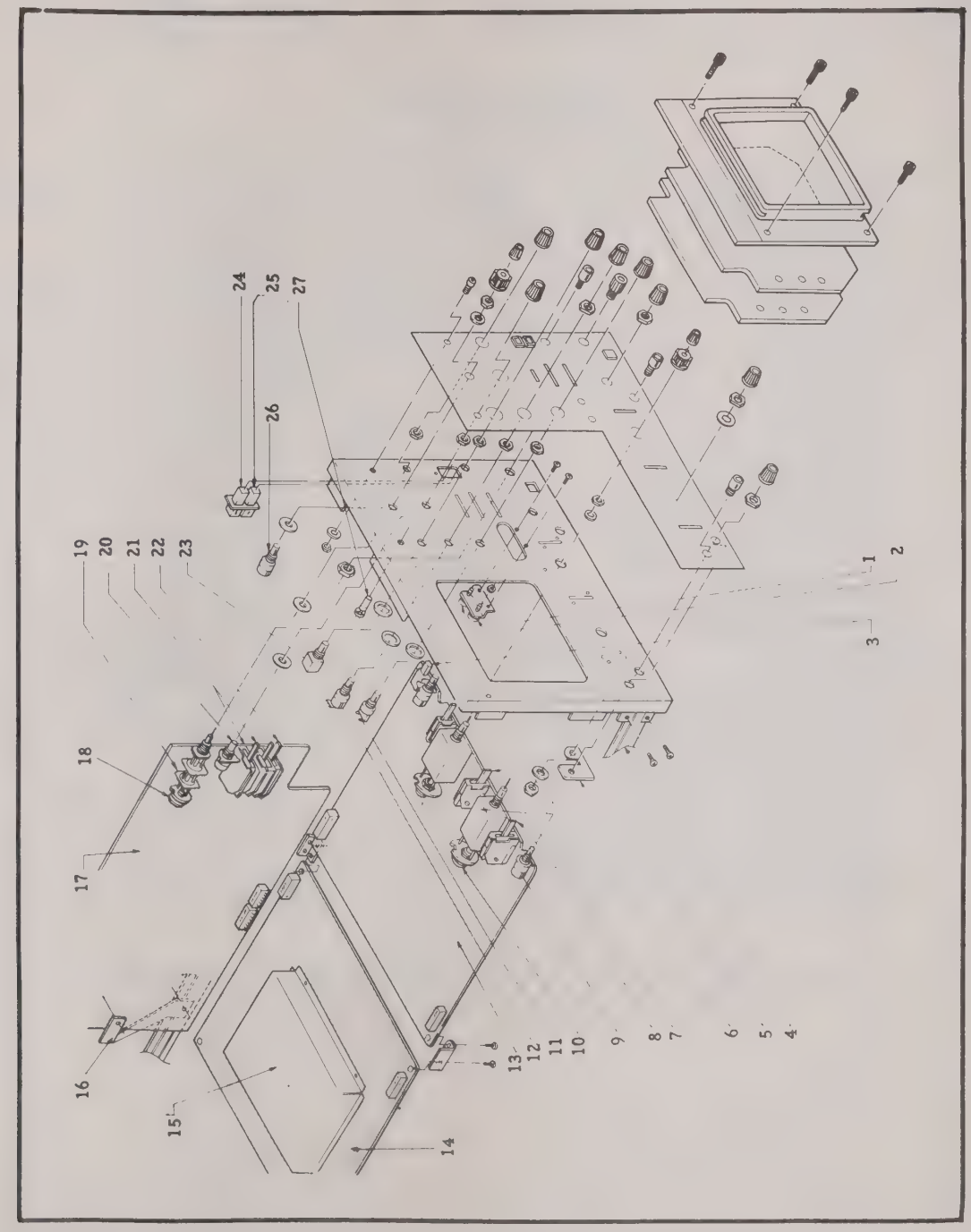


Fig. 30. Mechanical Disassembly.

Parts List for Fig. 31

INDEX NUMBER	DESCRIPTION	B & K-PRECISION PART NUMBER	1	2	3	4
1	CRT Band (upper)	741-096-9-003	X			
1	CRT Band (upper)	741-199-9-001		X	X	
1	CRT Band (Set)	741-127-9-002				X
2	CRT Band (lower)	741-096-9-004	X			
2	CRT Band (lower)	741-119-9-002		X		
3	CRT Socket	749-080-9-001	X	X	X	X
4	CRT Shield	256-061-9-002	X	X	X	
4	CRT Shield	256-095-9-001				X
5	CRT Shield	256-061-9-001	X	X	X	
5	CRT Shield	256-095-9-001		X	X	
6	Shield Case	256-064-9-003	X	X	X	
6	CRT Metal Mount	251-505-9-001				X
7	CRT (Type H9155-P31)	230-014-9-001	X			
7	CRT (Type H9155A-P31 or E2729B31A)	230-017-9-003		X	X	
7	CRT (Type 140CGB31)	230-020-9-001				X
8	CRT Trace Rotation Coil	041-132-9-001				X
9	Mounting Rubber	381-077-9-001	X			
9	Mounting Rubber	381-091-9-001		X	X	
9	Mounting Rubber	381-090-9-001				X
10	Delay Line	041-082-9-001	X	X	X	X
11	Vertical Output Amplifier Board	523-177-9-001	X	X	X	
11	Vertical Output Amplifier Board	523-454-9-001				X
12	PCB Mounting Bracket	251-192-9-001	X			
12	PCB Mounting Bracket	251-459-9-001		X	X	X
13	CRT Cover	260-094-9-002	X			
13	CRT Cover	763-139-9-001		X		
13	CRT Cover	763-146-9-001			X	
14	Power Transformer	065-130-9-001	X	X	X	
14	Power Transformer	065-154-9-001				X

Code: 1 = Model 1474, 2 = Model 1479, 3 = Model 1479A, 4 = Model 1479B

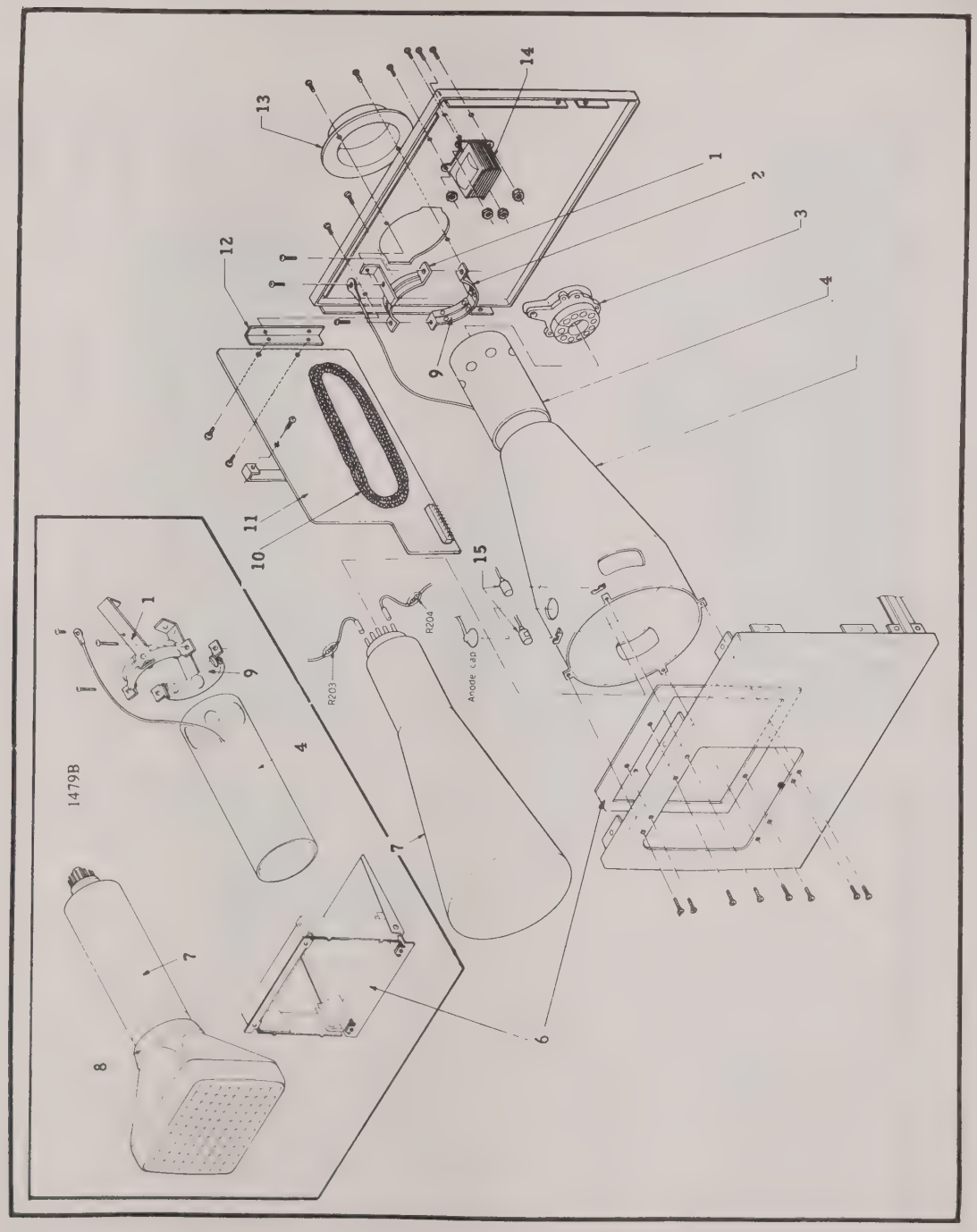


Fig. 31. CRT Removal.

Parts List for Fig. 32

INDEX NUMBER	DESCRIPTION	B & K-PRECISION PART NUMBER	1	2	3	4
1	Foam Cushion	502-125-9-001	X	X	X	X
2	Protection Board	502-131-9-001	X	X	X	X
3	Foam Cushion	502-125-9-001	X	X	X	X
4	Carton (1474)	500-296-9-001	X			
4	Carton (1479)	500-440-9-001		X		
4	Carton (1479A)	500-445-9-001			X	
4	Carton (1479B)	500-458-9-001				X
5	Probe (PR-40, 2 supplied)	535-040-0-000	X	X	X	X
6	Plastic Bag	502-132-9-001	X	X	X	X
7	Instruction Manual (1474)	480-187-9-001	X			
7	Instructtion Manual (1479)	480-264-9-001		X		
7	Instruction Manual (1479A)	480-280-9-001			X	
7	Instruction Manual (1479B)	480-302-9-001				X
8	Composite (1474)	499-181-9-001	X			
8	Composite (1479)	499-161-9-001		X		
8	Composite (1479A)	499-173-9-001			X	
8	Composite (1479B)	499-202-9-001				X
9	Warranty Card	491-199-9-001	X	X	X	X
10	Factory Service List	492-036-0-000	X	X	X	X
11	Spare Fuse (0.7A)	191-011-9-001	X	X	X	X
12	Spare Fuse (0.3 A)	191-010-9-001	X	X	X	X
13	220-240 V Label	483-227-9-001	X	X	X	X
14	Plastic Bag	502-090-9-001	X	X	X	X

Code: 1 = Model 1474, 2 = Model 1479, 3 = Model 1479A, 4 = Model 1479B

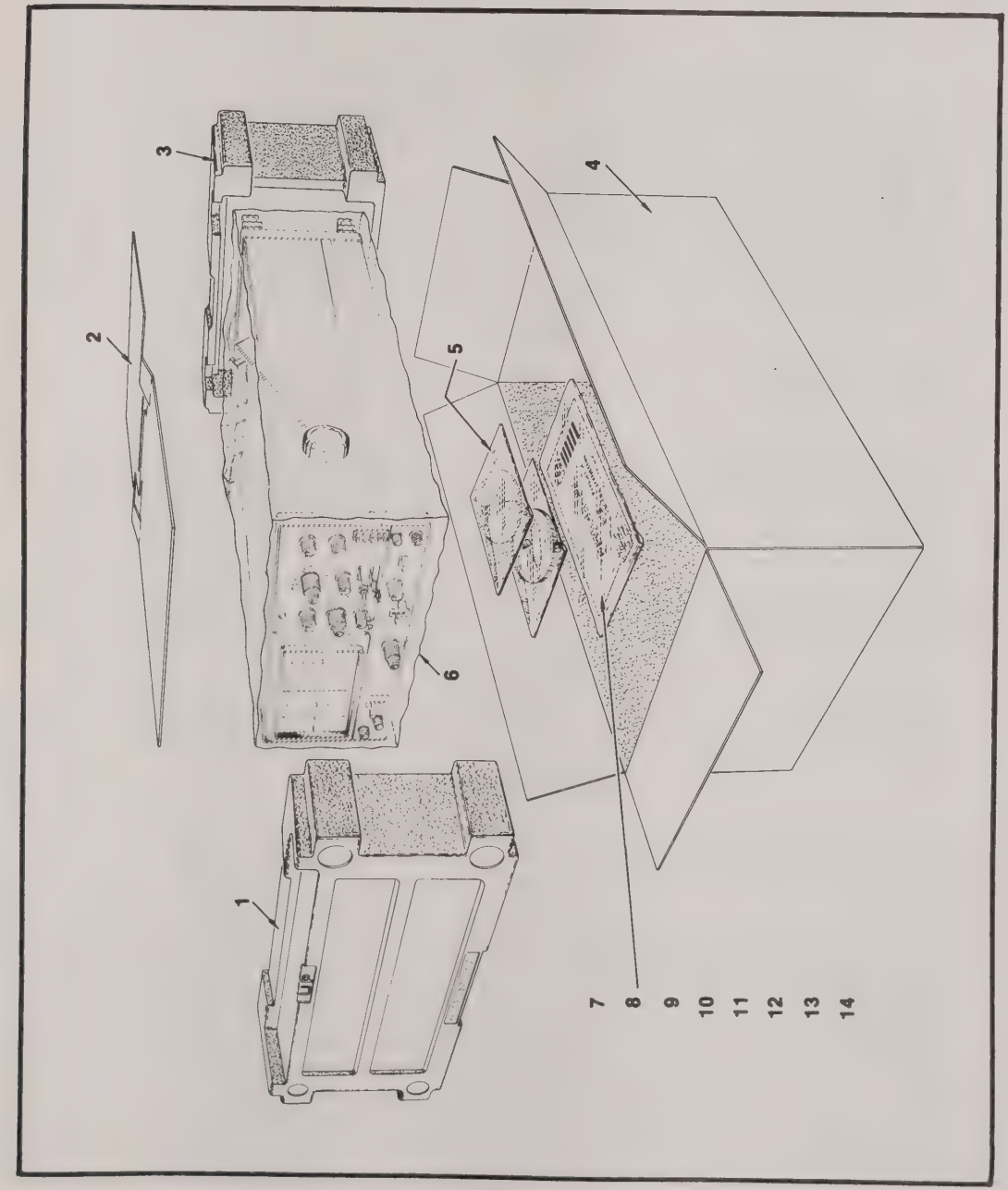


Fig. 32. Packing Drawing.

SCHEMATIC SYMBOL	DESCRIPTION	B & K-PRECISION PART NUMBER	1	2	3	4
	MAIN CHASSIS ASSEMBLY					
	RESISTORS					
	Unlisted resistors are ±5%, 1/4 W. See schematic diagram for value.					
VR201	500 Ω Potentiometer (Intensity)	008-267-9-002	X	X	X	X
VR202	5 KΩ Potentiometer (Hor. Position)	008-226-9-002	X	X	X	X
VR203	250 KΩ Potentiometer (Astigmatism)	008-226-9-005	X			
VR203	250 KΩ Potentiometer (Astigmatism)	008-226-9-003		X	X	X
VR204	1 KΩ Potentiometer (Power,Illum.)	008-298-9-005	X	X	X	
VR205	3 MΩ Potentiometer (Focus)	008-235-9-001	X	X	X	X
VR206	10 KΩ Potentiometer (Trace Rotation)	008-267-9-003			X	
	DIODES					
D201	LED (Pilot Lamp)	400-065-9-001		X	X	X
	LAMPS					
	Lamp, Scale Illumination	742-012-9-001	X			
	Lamp, Scale Illumination	400-063-9-001		X	X	
	Lamp, Scale Illumination	400-085-9-001				
	SWITCHES					
S201	Switch, Push (Norm/Fix)	088-032-9-002	X	X		
S202	Switch, Push (Video)	088-061-9-001			X	X
S203	Switch, Push (Norm/Fix)	088-061-9-001			X	X
	TRANSFORMERS					
	Transformer, Power	065-130-9-001	X	X	X	
	Transformer, Power	065-154-9-001				X
	MISCELLANEOUS					
	CRT, H9155-P31	230-014-9-001	X			
	CRT, H9155A-P31 or E2729B31A	230-017-9-001		X	X	
	CRT, 140CGB31	230-020-9-001				X
	CRT Socket	749-080-9-001	X	X	X	X
	Fuse, 0.7 A Fast Blow (120 VAC)	191-011-9-001	X	X	X	X
	Fuse, 0.3 A Fast Blow (240 VAC)	191-010-9-001		X	X	X
	Fuse Holder	742-029-9-001	X	X	X	X
	BNC Receptacle	773-071-9-001	X			
	BNC Receptacle	773-090-9-001		X	X	X
	Bezel	980-266-9-003	X			
	Bezel	380-339-9-002		X	X	
	Bezel	380-429-9-002				X
	Bezel Frame	769-102-9-002		X	X	X
	Bezel Shield	256-087-9-001		X	X	

Code: 1 = Model 1474, 2 = Model 1479, 3 = Model 1479A, 4 = Model 1479B

INDEX NUMBER	DESCRIPTION	B & K-PRECISION PART NUMBER	1	2	3	4
	Graticule Scale	380-270-9-002	X			
	Graticule Scale	482-164-9-002		X		
	Graticule Scale	482-164-9-001			X	
	CRT Filter (blue)	380-270-9-001	X			
	CRT Filter (blue)	380-338-9-001		X	X	
	CRT Filter (blue)	380-364-9-003				X
	Handle	746-033-9-001	X			
	Handle	746-041-9-001		X	X	X
	Handle Cover (2 used)	763-138-9-001		X	X	X
	Spring, Handle	767-070-9-001	X			
	Foot, Rubber (4 used)	381-069-9-001	X			
	Foot, Rubber (4 used)	381-090-9-002		X	X	X
	Foot/Cord Wrap (4 used)	380-270-9-005	X			
	Foot/Cord Wrap (4 used)	380-338-9-006		X	X	X
	Bushing, Rubber (4 used)	381-077-9-002	X			
	Bushing, Rubber (4 used)	381-091-9-002		X	X	X
	Case (Top)	272-118-9-001	X			
	Case (Top)	272-146-9-001		X	X	X
	Case (Bottom)	272-118-9-002	X			
	Case (Bottom)	272-151-9-001		X		
	Case (Bottom)	272-155-9-001			X	X
	Knob (Sweep Time/Div)	751-120-9-001	X			
	Knob (Sweep Time/Div)	751-186-9-001		X	X	X
	Knob (Pushbutton)	751-143-9-001	X			
	Knob (Pushbutton) Grey	751-187-9-002		X		X
	Knob (Pushbutton) Blue	751-194-9-001			X	
	Knob (Intensity, Focus, etc.)	751-124-9-001	X			
	Knob (Intensity, Focus, etc.)	751-186-9-002		X	X	X
	Knob (Variable)	751-138-9-001	X			
	Knob (Variable)	751-186-9-003		X	X	X
	Knob, Lever	751-138-9-003	X			
	Knob, Lever	751-186-9-004		X	X	X

Code: 1 = Model 1474, 2 = Model 1479, 3 = Model 1479A, 4 = Model 1479B

VERTICAL AMPLIFIER BOARD

RESISTORS

Unlisted resistors are ±5%, 1/4 W. See schematic diagram for value.

INDEX NUMBER	DESCRIPTION	B & K-PRECISION PART NUMBER	1	2	3	4
R102	900 KΩ 1/2 W ±1% Metal Film	013-010-9-011	X	X	X	X
R103	111 KΩ 1/2 W ±1% Metal Film	013-013-9-014	X	X	X	X
R104	990 KΩ 1/2 W ±1% Metal Film	013-010-9-012	X	X	X	X
R105	6.04 KΩ 1/4 W ±1% Metal Film	013-013-9-013	X			
R105	10.1 KΩ 1/4 W ±1% Metal Film	013-034-9-035		X	X	X
R106	4.02 KΩ 1/4 W ±1% Metal Film	013-013-9-012	X	X	X	X
R107	1 MΩ 1/2 W ±1% Metal Film	013-008-9-023	X	X	X	X
R109	900 KΩ 1/2 W ±1% Metal Film	013-010-9-011	X	X	X	X
R117	3.9 KΩ 1/4 W ±1% Metal Film	013-012-9-011	X	X	X	X
R118	3.9 KΩ 1/4 W ±1% Metal Film	013-012-9-011	X	X	X	X
R120	2.7 KΩ 1/4 W ±1% Metal Film	013-013-9-010	X	X	X	X
R121	3.3 KΩ 1/4 W ±1% Metal Film	013-013-9-011	X	X	X	X
R122	2.2 KΩ 1/ W ±1% Metal Film	013-013-9-009	X	X	X	X
R124	130 Ω 1/4 W ±1% Metal Film	013-013-9-007	X	X	X	X
R126	68 Ω 1/4 W ±1% Metal Film	013-013-9-005	X			
R126	69.8 Ω 1/4 W ±1% Metal Film	015-144-6-988		X	X	X
R127	100 Ω 1/4 W ±1% Metal Film	013-013-9-006	X	X	X	X
R128	100 Ω 1/4 W ±1% Metal Film	013-013-9-006	X	X	X	X
R129	100 Ω 1/4 W ±1% Metal Film	013-013-9-006	X	X	X	X
R130	10 Ω 1/4 W ±1% Metal Film	013-013-9-004	X	X	X	X
R135	150 Ω 1/4 W ±1% Metal Film	013-013-9-015	X	X	X	X
R139	3.9 KΩ 1/4 W ±1% Metal Film	013-012-9-011	X	X	X	X
R140	3.9 KΩ 1/4 W ±1% Metal Film	013-012-9-011	X	X	X	X
R141	120 Ω 1/4 W ±1% Metal Film	013-010-9-001	X	X	X	X
R155	560 Ω 1/4 W ±1% Metal Film	013-013-9-008	X	X	X	X
R156	560 Ω 1/4 W ±1% Metal Film	013-013-9-008	X	X	X	X
R162	900 KΩ 1/2 W ±1% Metal Film	013-010-9-011	X	X	X	X
R163	111 KΩ 1/2 W ±1% Metal Film	013-013-9-014	X	X	X	X
R164	990 KΩ 1/2 W ±1% Metal Film	013-010-9-012	X	X	X	X
R165	6.04 KΩ 1/4 W ±1% Metal Film	013-013-9-013	X			
R165	10.1 KΩ 1/4 W ±1% Metal Film	013-034-9-035		X	X	X
R166	4.02 KΩ 1/4 W ±1% Metal Film	013-013-9-012	X	X	X	X
R167	1 MΩ 1/2 W ±1% Metal Film	013-008-9-023	X	X	X	X
R180	2.7 KΩ 1/4 W ±1% Metal Film	013-013-9-010	X	X	X	X
R181	3.3 KΩ 1/4 W ±1% Metal Film	013-013-9-011	X	X	X	X
R182	2.2 KΩ 1/ W ±1% Metal Film	013-013-9-009	X	X	X	X
R184	130 Ω 1/4 W ±1% Metal Film	013-013-9-007	X	X	X	X
R186	68 Ω 1/4 W ±1% Metal Film	013-013-9-005	X			
R186	69.8 Ω 1/4 W ±1% Metal Film	015-144-6-988		X	X	X
R187	100 Ω 1/4 W ±1% Metal Film	013-013-9-006	X	X	X	X
R188	100 Ω 1/4 W ±1% Metal Film	013-013-9-006	X	X	X	X
R189	100 Ω 1/4 W ±1% Metal Film	013-013-9-006	X	X	X	X

Code: 1 = Model 1474, 2 = Model 1479, 3 = Model 1479A, 4 = Model 1479B

INDEX NUMBER	DESCRIPTION	B & K-PRECISION PART NUMBER	1	2	3	4
R190	10 Ω 1/4 W ±1% Metal Film	013-013-9-004	X	X	X	X
R195	150 Ω 1/4 W ±1% Metal Film	013-013-9-015	X	X	X	X
R215	560 Ω 1/4 W ±1% Metal Film	013-013-9-008	X	X	X	X
R216	560 Ω 1/4 W ±1% Metal Film	013-013-9-008	X	X	X	X
R224	270 Ω 1/4 W ±1% Metal Film	013-013-9-002	X	X	X	X
R225	270 Ω 1/4 W ±1% Metal Film	013-013-9-002	X	X	X	X
R226	91 Ω 1/4 W ±1% Metal Film	013-013-9-002	X	X	X	X
R227	91 Ω 1/4 W ±1% Metal Film	013-013-9-002	X	X	X	X
R233	2 KΩ 1/4 W ±1% Metal Film	013-012-9-010	X	X	X	X
R234	2 KΩ 1/4 W ±1% Metal Film	013-012-9-010	X	X	X	X
R239	996 KΩ 1/4 W ±1% Metal Film	013-124-9-012	X	X	X	X
R240	996 KΩ 1/4 W ±1% Metal Film	013-124-9-012	X	X	X	X
VR101	300 Ω Potentiometer	008-298-9-004	X			
VR101	470 Ω Potentiometer	008-341-9-013		X	X	X
VR102	300 Ω Poteneiometer	008-298-9-002	X	X	X	X
VR103	100 Ω Potentiometer	008-298-9-004	X	X	X	X
VR104	1 KΩ Potentiometer	008-374-9-004	X	X	X	X
VR105	2.2 KΩ Potentiometer	008-169-9-007	X	X	X	X
VR106	300 Ω Potentiometer	008-298-9-004	X			
VR106	470 Ω Potentiometer	008-341-9-013		X	X	X
VR107	300 Ω Potentiometer	008-298-9-002	X	X	X	X
VR108	100 Ω Potentiometer	008-298-9-004	X	X	X	X
VR109	1 KΩ Potentiometer	008-374-9-004	X	X	X	X
VR110	100Ω Potentiometer	008-298-9-001	X	X	X	X
VR111	100 Ω Potentiometer	008-298-9-001	X	X	X	X
VR112	2.2 KΩ Potentiometer	008-169-9-007	X	X	X	X
VR113	6.8 KΩ Potentiometer	008-382-9-002		X	X	X
	CAPACITORS					
C101	0.047 µF 630 V Metal Film	033-023-9-001	X	X	X	X
C103	47 pF 500 V ±5% Ceramic	023-056-9-002	X	X	X	X
C104	2 pF 500 V ±0.25 pF Ceramic	020-278-9-001	X	X	X	X
C105	150 pF 100 V ±5% Mica	023-061-9-001	X	X	X	X
C106	0.01 µF 630 V Metal Film	033-023-9-002	X	X	X	X
C107	0.01 µF 12 V Metal Film	033-018-9-001	X	X	X	X
C108	0.01 µF 12 V Metal Film	033-018-9-001	X	X	X	X
C109	0.01 µF 12 V Metal Film	033-018-9-001	X	X	X	X
C110	100 µF 10 V Electrolytic	022-123-9-002	X	X	X	X
C112	100 µF 10 V Electrolytic	022-123-9-002	X	X	X	X
C113	100 µF 10 V Electrolytic	022-123-9-002	X			
C114	0.047 µF 630 V Metal Film	033-023-9-001	X	X	X	X
C115	0.01 µF 630 V Metal Film	033-023-9-002	X	X	X	X
C117	47 pF 500 V ±5% Ceramic	023-056-9-002	X	X	X	X
C118	2 pF 500 V ±0.25 pF Ceramic	020-278-9-001	X	X	X	X
C119	150 pF 100 V ±5% Mica	023-061-9-001	X	X	X	X
C120	0.01 µF 12 V Metal Film	033-018-9-001	X	X	X	X
C121	0.01 µF 12 V Metal Film	033-018-9-001	X	X	X	X
C122	0.01 µF 12 V Metal Film	033-018-9-001	X	X	X	X

Code: 1 = Model 1474, 2 = Model 1479, 3 = Model 1479A, 4 = Model 1479B

INDEX NUMBER	DESCRIPTION	B & K-PRECISION PART NUMBER	1	2	3	4
C123	100 µF 10 V Electrolytic	022-123-9-002	X	X	X	X
C124	100 µF 10 V Electrolytic	022-123-9-002	X	X	X	X
C125	100 µF 10 V Electrolytic	022-123-9-002	X	X	X	X
C126	330 µF 10 V Electrolytic	022-149-9-001	X			
C126	100 µF 10 V Electrolytic	022-123-9-002		X	X	X
C127	0.01 µF 12 V Metal Film	033-018-9-001	X	X	X	X
C128	220 µF 10 V Electrolytic	022-086-9-022	X	X	X	X
C129	0.01 µF 12 V Metal Film	033-018-9-001	X	X	X	X
C130	0.01 µF 12 V Metal Film	033-018-9-001	X	X	X	X
C131	100 µF 10 V Electrolytic	022-123-9-002	X	X	X	X
C132	15 pF 50 V ±5% Ceramic	020-171-9-002		X	X	X
C133	22 pF 50 V ±5% Ceramic	020-215-9-002	X	X	X	X
C135	0.1 µF 12 V Metal Film	033-278-9-001		X	X	X
C136	100 µF 10 V Electrolytic	022-123-9-002	X			
C136	120 pF 50 V ±5% Ceramic	020-167-9-003		X	X	X
C137	15 pF 50 V ±5% Ceramic	020-171-9-002		X	X	X
C138	22 pF 50 V ±5% Ceramic	020-215-9-002	X	X	X	X
C140	5 pF 50 V ±0.25 pF Ceramic	020-233-9-002		X	X	X
C141	120 pF 50 V ±5% Ceramic	020-167-9-003		X	X	X
C142	0.01 µF 50 V ±10% Ceramic	020-296-9-001	X	X	X	X
C143	0.01 µF 50 V ±10% Ceramic	020-296-9-001	X	X	X	X
C144	0.01 µF 12 V Metal Film	033-018-9-001	X	X	X	X
C145	0.01 µF 50 V ±10% Ceramic	020-296-9-001	X	X	X	X
C146	0.01 µF 50 V ±10% Ceramic	020-296-9-001	X	X	X	X
C147	0.01 µF 50 V ±20% Ceramic	020-142-9-012	X			
C147	0.01 µF 12 V Metal Film	033-018-9-001		X	X	X
C148	0.10 µF 50 V ±20% Ceramic	020-142-9-012	X			
C148	330 pF 100 V ±5% Mica	023-061-9-002		X	X	X
C149	2 pF 500 V ±0.25 pF Ceramic	020-278-9-001	X	X	X	X
C150	2 pF 500 V ±0.25 pF Ceramic	020-278-9-001	X	X	X	X
C151	330 pF 100 V ±5% Mica	023-061-9-002		X	X	X
C154	15 pF 50 V ±5% Ceramic	020-171-9-002		X	X	
C154	22 pF 50 V ±5% Ceramic	020-215-9-002				X
C155	15 pF 50 V ±5% Ceramic	020-171-9-002		X	X	
C156	10 pF 50 V ±0.5 pF Ceramic	020-215-9-001		X	X	X
C157	10 pF 50 V ±0.5 pF Ceramic	020-215-9-001		X	X	X
C158	10 pF 50 V ±0.5 pF Ceramic	020-215-9-001		X	X	X
C159	10 pF 50 V ±0.5 pF Ceramic	020-215-9-001		X	X	X
C160	10 pF 50 V ±0.5 pF Ceramic	020-215-9-001		X	X	X
TC101	6 pF Trimmer	028-033-9-001	X	X	X	X
TC102	10 pF Trimmer	028-033-9-002	X	X	X	X
TC103	6 pF Trimmer	028-033-9-001	X	X	X	X
TC104	10 pF Trimmer	028-033-9-002	X	X	X	X
TC105	6 pF Trimmer	028-039-9-001	X			
TC105	6 pF Trimmer	028-033-9-001		X	X	X
TC106	6 pF Trimmer	028-033-9-001	X	X	X	X
TC107	10 pF Trimmer	028-033-9-002	X	X	X	X
TC108	6 pF Trimmer	028-033-9-001	X	X	X	X

Code: 1 = Model 1474, 2 = Model 1479, 3 = Model 1479A, 4 = Model 1479B

INDEX NUMBER	DESCRIPTION	B & K-PRECISION PART NUMBER	1	2	3	4
TC109	10 pF Trimmer	028-033-9-002	X	X	X	X
TC110	6 pF Trimmer	028-039-9-001	X			
TC110	6 pF Trimmer	028-033-9-001		X	X	X
TC111	10 pF Trimmer	028-033-9-002		X	X	X
TC112	10 pF Trimmer	028-033-9-002		X	X	X
TC113	20 pF Trimmer	028-039-9-001		X	X	X
	DIODES					
D101	1S1587 Diode Silicon	151-048-9-001	X	X	X	X
D102	1S1587 Diode Silicon	151-048-9-001	X	X	X	X
D103	1S1587 Diode Silicon	151-048-9-001	X	X	X	X
D104	1S1587 Diode Silicon	151-048-9-001	X	X	X	X
D105	1S1587 Diode Silicon	151-048-9-001	X	X	X	X
D106	1S1587 Diode Silicon	151-048-9-001	X	X	X	X
D107	1S1587 Diode Silicon	151-048-9-001	X	X	X	X
D108	1S1587 Diode Silicon	151-048-9-001	X	X	X	X
D109	1S1555 Diode Silicon	151-028-9-007	X	X	X	X
D110	1S1555 Diode Silicon	151-028-9-007	X	X	X	X
D111	1S1555 Diode Silicon	151-028-9-007	X	X	X	X
D112	1S1555 Diode Silicon	151-028-9-007	X	X	X	X
D113	1S1555 Diode Silicon	151-028-9-007	X	X	X	X
D114	1S1555 Diode Silicon	151-028-9-007	X	X	X	X
D115	1S1555 Diode Silicon	151-028-9-007	X	X	X	X
D116	1S1555 Diode Silicon	151-028-9-007	X	X	X	X
D117	1S1555 Diode Silicon	151-028-9-007	X	X	X	X
D118	1S1555 Diode Silicon	151-028-9-007	X	X	X	X
D119	1S1555 Diode Silicon	151-028-9-007	X	X	X	X
D120	1S1555 Diode Silicon	151-028-9-007	X	X	X	X
D121	1S1555 Diode Silicon	151-028-9-007	X	X	X	X
D122	1S1587 Diode Silicon	151-048-9-001	X	X	X	X
D123	1S1587 Diode Silicon	151-048-9-001	X	X	X	X
D124	1N60 Diode Germanium	150-001-9-005		X	X	X
	TRANSISTORS					
Q101	2SK30A-1 FET	182-026-9-001	X	X	X	X
Q102	E412S-B Dual FET	182-039-9-001	X			
Q102	2SK228-1-2 Dual FET	182-059-9-001		X	X	
Q102	2SK228-T-2 (3) Dual FET	182-061-9-001				X
Q103	2SC535-B Transistor NPN	176-036-9-001	X	X	X	X
Q104	2SC535-B Transistor NPN	176-036-9-001	X	X	X	X
Q105	2SC535-B Transistor NPN	176-036-9-001	X	X	X	X
Q106	2SC535-B Transistor NPN	176-036-9-001	X	X	X	X
Q107	2SA844D Transistor PNP	077-021-9-001	X			
Q107	2SA838C Transistor PNP	177-036-9-001		X	X	X
Q108	2SA844D Transistor PNP	077-021-9-001	X			
Q108	2SA838C Transistor PNP	177-036-9-001		X	X	X
Q109	2SC535-B Transistor NPN	176-036-9-001	X	X	X	X
Q110	2SC535-B Transistor NPN	176-036-9-001	X	X	X	X
Q111	25K30A-1 FET	182-026-9-001	X	X	X	X

Code: 1 = Model 1474, 2 = Model 1479, 3 = Model 1479A, 4 = Model 1479B

INDEX NUMBER	DESCRIPTION	B & K-PRECISION PART NUMBER	1	2	3	4
Q112	E412S-B Dual FET	182-039-9-001	X			
Q112	2SK228-1-2 Dual FET	182-059-9-001		X	X	
Q112	2SK228-T-2 (3) Dual FET	182-061-9-001				X
Q113	2SC535-B Transistor NPN	176-036-9-001	X	X	X	X
Q114	2SC535-B Transistor NPN	176-036-9-001	X	X	X	X
Q115	2SC535-B Transistor NPN	176-036-9-001	X	X	X	X
Q116	2SC535-B Transistor NPN	176-036-9-001	X	X	X	X
Q117	2SA844D Transistor PNP	077-021-9-001	X			
Q117	2SA838C Transistor PNP	177-036-9-001		X	X	X
Q118	2SA844D Transistor PNP	077-021-9-001	X			
Q118	2SA838C Transistor PNP	177-036-9-001		X	X	X
Q119	2SC535-B Transistor NPN	176-036-9-001	X	X	X	X
Q120	2SC535-B Transistor NPN	176-036-9-001	X	X	X	X
Q121	2SC535-B Transistor NPN	176-036-9-001	X	X	X	X
Q122	2SC535-B Transistor NPN	176-036-9-001	X	X	X	X
Q123	25A844-D Transistor PNP	177-021-9-001	X	X	X	X
Q124	25A844-D Transistor PNP	177-021-9-001	X	X	X	X
Q125	2SC458C Transistor NPN	176-016-9-001	X	X	X	X
Q126	2SC458C Transistor NPN	176-016-9-001	X	X	X	X
Q127	25A844-D Transistor PNP	177-021-9-001	X	X	X	X
	INTEGRATED CIRCUITS					
IC101	Linear I.C.	307-106-9-001	X	X	X	X
IC102	Linear I.C.	307-106-9-001	X	X	X	X
IC103	Digital I.C.	307-069-9-001	X	X	X	
IC103	Digital I.C.	307-101-9-004				X
IC104	Digital I.C.	307-069-9-003	X	X	X	
IC103	Digital I.C.	307-296-9-004				X
	INDUCTORS					
L101	22 µH Ferri-Inductor	041-068-9-004	X	X	X	X
L102	22 µH Ferri-Inductor	041-068-9-004	X	X	X	X
	SWITCHES					
S101	Lever Switch (AC-GND-DC)	080-003-9-001	X	X	X	X
S102	Lever Switch (AC-GND-DC)	080-003-9-001	X	X	X	X
S103	Rotary Switch (Volts/Div)	083-212-9-001	X	X	X	
S103	Rotary Switch (Volt/Div)	083-266-9-001				X
S104	Rotary Switch (Volts/Div)	083-212-9-001	X	X	X	
S104	Rotary Switch (Volt/Div)	083-266-9-001				X
S105	Push Switch (CH B Polarity)	088-032-9-001	X	X	X	X
S106	Lever Switch (Mode)	086-004-9-002	X	X	X	X

Code: 1 = Model 1474, 2 = Model 1479, 3 = Model 1479A, 4 = Model 1479B

INDEX NUMBER	DESCRIPTION	B & K-PRECISION PART NUMBER	1	2	3	4
	VERTICAL OUTPUT AMPLIFIER BOARD					
	RESISTORS					
	Unlisted resistors are ±5%, 1/4 W. See schematic diagram for value.					
R401	91 Ω 1/4 ±1% Metal Film	013-013-9-003	X	X	X	X
R402	91 Ω 1/4 ±1% Metal Film	013-013-9-003	X	X	X	X
R422	470 Ω 1/4 ±1% Metal Film	013-013-9-001	X	X	X	X
R423	470 Ω 1/4 ±1% Metal Film	013-013-9-001	X	X	X	X
R428	75 KΩ 1/4 ±1% Metal Film	013-013-9-002	X	X	X	X
R429	75 KΩ 1/4 ±1% Metal Film	013-013-9-002	X	X	X	X
VR401	100 Ω Potentiometer	008-298-9-001	X			
VR401	220 Ω Potentiometer	008-382-9-001		X	X	X
VR402	47 KΩ Potentiometer	008-155-9-003	X	X	X	X
VR403	1 KΩ Potentiometer	008-155-9-005	X	X	X	X
VR404	47 KΩ Potentiometer	008-155-9-003		X	X	
VR404	220 KΩ Potentiometer	008-155-9-007				X
VR405	1 KΩ Potentiometer	008-155-9-005	X	X	X	X
	CAPACITORS					
C40	1 pF 50 V ±0.25 pF Ceramic	020-142-9-001		X	X	X
C41	3 pF 50 V ±0.25 pF Ceramic	020-233-9-001		X	X	X
C401	0.1 µF 50 V Ceramic	033-018-9-001	X	X	X	X
C402	0.1 µF 50 V Ceramic	033-018-9-001	X	X	X	X
C403	330 µF 10 V ±20% Electrolytic	022-238-9-001	X	X	X	X
C405	10 pF 50 V ±0.5 pF Ceramic	020-215-9-001		X	X	X
C406	0.033 µF 50 V ±10% Mylar	025-056-9-004		X	X	X
C407	220 pF 50 V Mylar	020-296-9-004		X	X	
C407	2200 pF 50 V ±10% Ceramic	020-269-9-004				X
C408	10,000 pF 50 V ±10% Ceramic	020-296-9-001	X	X	X	X
C409	10 pF 50 V ±0.5 pF Ceramic	020-215-9-001		X	X	X
C410	15 pF 50 V Ceramic	020-171-9-002		X	X	
C411	220 µF 25 V Electrolytic	022-086-9-003	X	X	X	X
C412	100 µF 16 V Electrolytic	022-073-9-022	X	X	X	X
C413	0.1 µF 50 V Ceramic	033-018-9-001	X	X	X	X
C414	47 µF 16 V Electrolytic	022-090-9-003	X	X	X	X
C415	10,000 pF 50 V ±10% Ceramic	020-296-9-001	X	X	X	X
C416	10,000 pF 50 V ±10% Electrolytic	020-296-9-007	X	X	X	X
C417	1 pF 50 V ±0.25 pF Electrolytic	020-142-9-008	X	X	X	X
C418	1 pF 50 V ±0.25 pF Electrolytic	020-142-9-008	X	X	X	X
C419	10,000 pF 50 V ±10% Ceramic	020-296-9-001	X	X	X	X
C420	10,000 pF 50 V ±10% Ceramic	020-296-9-001	X	X	X	X
C421	15 pF 50 V ±10% Electrolytic	020-171-9-002	X			
C421	33 pF 50 V ±5% Ceramic	020-238-9-001		X	X	X
C422	15 pF 50 V ±10% Electrolytic	020-171-9-002	X			
C422	33 pF 50 V ±5% Ceramic	020-238-9-001		X	X	X

Code: 1 = Model 1474, 2 = Model 1479, 3 = Model 1479A, 4 = Model 1479B

INDEX NUMBER	DESCRIPTION	B & K-PRECISION PART NUMBER	1	2	3	4
C423	220 pF 50 V ±10% Ceramic	020-124-9-008	X			
C423	100 pF 50 V Ceramic	020-103-9-001		X	X	X
C424	220 pF 50 V ±10% Ceramic	020-124-9-008	X			
C424	100 pF 50 V Ceramic	020-103-9-001		X	X	X
C425	10,000 pF 50 V ±10% Ceramic	020-296-9-001	X	X	X	X
C426	3300 pF 500 V ±10% Ceramic	020-296-9-006	X	X	X	X
C427	3300 pF 500 V ±10% Ceramic	020-296-9-006	X	X	X	X
C428	10,000 pF 50 V ±10% Electrolytic	020-296-9-007	X	X	X	X
C429	10,000 pF 50 V ±10% Electrolytic	020-296-9-007	X	X	X	X
C430	0.1 µF 50 V Ceramic	033-018-9-001	X	X	X	X
C431	10,000 pF 50 V ±10% Ceramic	020-296-9-001	X	X	X	X
C432	0.1 µF 50 V Ceramic	033-018-9-001	X	X	X	X
C433	330 µF 10 V Electrolytic	022-149-9-001	X			
C433	100 µF 10 V Electrolytic	022-123-9-002		X	X	X
C434	220 µF 25 V Electrolytic	022-086-9-003	X	X	X	X
C435	0.1 µF 50 V Ceramic	033-018-9-001	X	X	X	X
C436	220 µF 25 V Electrolytic	022-086-9-003	X			
C436	100 µF 25 V Electrolytic	022-123-9-001		X	X	X
C437	100 pF 50 V Ceramic	020-250-9-002		X	X	
C437	82 pF 50 V Ceramic	020-250-9-002				X
C439	220 pF 50 V Ceramic	020-124-9-008		X	X	X
C442	15 pF 50 V ±5% Ceramic	020-171-9-002				X
TC401	10 pF Ceramic Trimmer	028-033-9-002	X			
TC401	20 pF Ceramic Trimmer	028-039-9-001		X	X	X
TC402	10 pF Ceramic Trimmer	028-033-9-002	X	X	X	X
TC403	10 pF Ceramic Trimmer	028-033-9-002	X	X	X	X
TC404	20 pF Ceramic Trimmer	028-039-9-001		X	X	X
	DIODES					
D401	1S1587 Silicon	151-048-9-001	X	X	X	X
D402	1S1587 Silicon	151-048-9-001	X	X	X	X
D403	WZ130 Zener	152-076-9-001	X	X	X	X
D404	WZ050 Zener	152-069-9-001	X	X	X	X
D405	1S1555 Silicon	151-028-9-007	X	X	X	X
D406	1S1555 Silicon	151-028-9-007	X	X	X	X
D407	WZ050 Zener	152-069-9-001	X	X	X	X
D408	1S1587 Silicon	151-048-9-001		X	X	X
D409	1S1587 Silicon	151-048-9-001		X	X	X
	TRANSISTORS					
Q401	2SC535B NPN Transistor	176-036-9-001	X	X	X	X
Q402	2SC535B NPN Transistor	176-036-9-001	X	X	X	X
Q403	2SC535B NPN Transistor	176-036-9-001	X	X	X	X
Q404	2SC535B NPN Transistor	176-036-9-001	X	X	X	X
Q405	2SC458C NPN Transistor	176-016-9-001	X	X	X	X
Q406	2SC458C NPN Transistor	176-016-9-001	X	X	X	X
Q407	2SC458C NPN Transistor	176-016-9-001	X	X	X	X
Q408	2SC458C NPN Transistor	176-016-9-001	X	X	X	X

Code: 1 = Model 1474, 2 = Model 1479, 3 = Model 1479A, 4 = Model 1479B

INDEX NUMBER	DESCRIPTION	B & K-PRECISION PART NUMBER	1	2	3	4
Q409	2SC458C NPN Transistor	176-016-9-001	X	X	X	X
Q410	2SC1628Y NPN Transistor	176-055-9-005	X	X	X	X
Q411	2SC1628Y NPN Transistor	176-055-9-005	X	X	X	X
Q412	2SA818Y PNP Transistor	176-018-9-003	X	X	X	X
Q413	2SA818Y PNP Transistor	176-018-9-003	X	X	X	X
Q414	2SK19BL FET	182-037-9-001	X			
Q414	2SK19GR FET	182-029-9-001		X	X	X
Q415	2SA818Y PNP Transistor	176-018-9-003	X	X	X	X
Q415	2SK19GR FET	182-029-9-001		X	X	X
Q416	2SC535B NPN Transistor	176-036-9-001	X			
Q416	2SC1047C NPN Transistor	176-036-9-001		X	X	X
Q417	2SC535B NPN Transistor	176-036-9-001	X			
Q417	2SC1047C NPN Transistor	176-036-9-001		X	X	X
Q418	2SC458C NPN Transistor	176-016-9-001	X	X	X	X
Q419	2SC458C NPN Transistor	176-016-9-001	X	X	X	X
	INDUCTORS					
L401	47 µH Ferri-Inductor	041-068-9-002	X	X	X	X
L402	Fixed Ferri-Inductor	041-082-9-001	X	X	X	X
L403	Fixed Ferri-Inductor	014-082-9-001	X	X	X	X
L406	22 µH Ferri-Inductor	041-089-9-001	X	X	X	X
L407	1 µH Ferri-Inductor	041-089-9-002	X	X	X	
L408	1 µH Ferri-Inductor	041-089-9-002	X	X	X	
	THERMISTORS					
TH401	SDT1000 Thermistor	005-003-9-002		X	X	
TH401	SDT100 Thermistor	005-006-9-001				X
TH402	SDT1000 Thermistor	005-003-9-002		X	X	
TH402	SDT100 Thermistor	005-006-9-001				X
TH403	SDT1000 Thermistor	005-003-9-002		X	X	
TH403	SDT100 Thermistor	005-006-9-001				X

Code: 1 = Model 1474, 2 = Model 1479, 3 = Model 1479A, 4 = Model 1479B

HORIZONTAL AMP & SWEEP BOARD

RESISTORS

Unlisted resistors are ±5%, 1/4 W. See schematic diagram for value.

INDEX NUMBER	DESCRIPTION	B & K-PRECISION PART NUMBER	1	2	3	4
R26	10 KΩ 1/4 W ±1% Metal Film	013-013-9-016	X	X		
R27	100 KΩ 1/4 W ±1% Metal Film	013-008-9-020			X	X
R28	10 KΩ 1/4 W ±1% Metal Film	013-013-9-016	X	X		
R28	3 MΩ 1/4 W ±1% Metal Film	004-165-9-001			X	X
R29	30 KΩ 1/4 W ±1% Metal Film	013-013-9-017	X	X		
R29	1 MΩ 1/2 W ±1% Metal Film	013-008-9-023			X	X
R30	50 KΩ 1/2 W ±1% Metal Film	013-013-9-018	X	X		
R30	500 KΩ 1/2 W ±1% Metal Film	013-088-9-022			X	X
R31	100 KΩ 1/2 W ±1% Metal Film	013-013-9-019	X	X		
R31	300 KΩ 1/4 W ±1% Metal Film	013-008-9-021			X	X
R32	100 KΩ 1/4 W ±1% Metal Film	002-104-5-104	X	X		
R32	100 KΩ 1/4 W ±1% Metal Film	013-008-9-020			X	X
R33	47 KΩ 1/4 W ±1% Metal Film	002-104-5-473	X	X		
R35	100 Ω 1/4 W ±1% Metal Film	002-104-5-101	X	X		
R36	8.2 KΩ 1/4 W ±1% Metal Film	002-104-5-822	X	X		
R37	6.9 KΩ 1/4 W ±1% Metal Film	002-104-5-682	X	X		
R39	8.2 KΩ 1/4 W ±1% Metal Film	002-104-5-682	X	X		
R43	100 Ω 1/4 W ±1% Metal Film	002-104-5-101	X	X		
R45	100 Ω 1/4 W ±1% Metal Film	002-104-5-101	X	X		
R47	100 Ω 1/4 W ±1% Metal Film	002-104-5-101	X	X		
R50	100 KΩ 1/4 W ±1% Metal Film	002-104-5-104	X	X		
R51	100 KΩ 1/4 W ±1% Metal Film	002-104-5-104	X	X		
R52	100 KΩ 1/4 W ±1% Metal Film	002-104-5-104	X	X		
R56	8.2 KΩ 1/4 W ±1% Metal Film	002-104-5-822	X	X		
R59	100 Ω 1/4 W ±1% Metal Film	002-104-5-101	X	X		
R60	100 Ω 1/4 W ±1% Metal Film	002-104-5-101	X	X		
R68	100 KΩ 1/4 W ±1% Metal Film	013-008-9-020				X
R69	100 KΩ 1/4 W ±1% Metal Film	013-008-9-020				X
R71	100 Ω 1/4 W ±1% Metal Film	002-104-5-101	X	X		
R78	8.2 KΩ 1/4 W ±1% Metal Film	002-104-5-822	X	X		
R79	100 Ω 1/4 W ±1% Metal Film	002-104-5-101	X	X		
R80	8.2 KΩ 1/4 W ±1% Metal Film	002-104-5-682	X	X		
R82	8.2 KΩ 1/4 W ±1% Metal Film	002-104-5-682	X	X		
R83	100 Ω 1/4 W ±1% Metal Film	002-104-5-101	X	X		
R84	100 Ω 1/4 W ±1% Metal Film	002-104-5-101	X	X		
R85	100 Ω 1/4 W ±1% Metal Film	002-104-5-101	X	X		
R89	100 Ω 1/4 W ±1% Metal Film	002-104-5-101	X	X		
R92	5.1 KΩ 2 W ±1% Metal Film	013-047-9-001		X		
R128	4.7 KΩ 2 W ±2% Metal Film	013-013-9-021			X	X
R129	5.1 KΩ 2 W ±2% Metal Film	013-047-9-001			X	X
R132	4.7 KΩ 1/4 W ±1% Metal Film	013-061-9-001				X
R133	4.7 KΩ 1/4 W ±1% Metal Film	013-061-9-001				X

Code: 1 = Model 1474, 2 = Model 1479, 3 = Model 1479A, 4 = Model 1479B

INDEX NUMBER	DESCRIPTION	B & K-PRECISION PART NUMBER	1	2	3	4
VR1	10 KΩ Potentiometer	008-298-9-010	X	X	X	X
VR2	100 KΩ Potentiometer	008-298-9-013	X	X	X	X
VR3	100 KΩ Potentiometer	008-298-9-013	X	X	X	X
VR4	5 KΩ Potentiometer with Switch	008-298-9-006			X	X
VR5	100 KΩ Potentiometer	008-298-9-013	X	X	X	X
VR6	4.7 KΩ Potentiometer	008-298-9-009	X	X	X	X
VR7	4.7 KΩ Potentiometer	008-298-9-012	X	X		
VR7	15 KΩ Potentiometer	008-379-9-001			X	X
VR8	50 KΩ Potentiometer with Switch	008-298-9-007	X			
VR8	50 KΩ Potentiometer with Switch	008-381-9-001		X	X	X
VR9	2.2 MΩ Potentiometer	008-268-9-014	X	X	X	
VR10	10 KΩ Potentiometer	008-298-9-010	X	X		
VR10	47 KΩ Potentiometer	008-298-9-012			X	X
VR11	1 KΩ Potentiometer	008-298-9-008	X	X	X	X
VR12	4.7 KΩ Potentiometer	008-298-9-009	X			
VR12	2.2 KΩ Potentiometer	008-373-9-007		X		
VR12	1 KΩ Potentiometer	008-298-9-008			X	X
VR13	100 Ω Potentiometer	008-298-9-001	X	X		
VR13	1 KΩ Potentiometer	008-298-9-008			X	X
VR14	100 Ω Potentiometer	008-298-9-001	X	X		
VR14	6.8 KΩ Potentiometer	008-382-9-002			X	X
VR15	22 KΩ Potentiometer	008-298-9-011	X	X	X	X
VR16	150 Ω Potentiometer	008-174-9-002		X		
VR16	10 KΩ Potentiometer	008-298-9-001			X	X
VR17	100 Ω Potentiometer	008-298-9-001			X	X
	CAPACITORS					
C1	6800 pF ±5% 50 V Mylar	025-136-9-004	X	X	X	X
C2	6800 pF ±5% 50 V Mylar	025-136-9-004	X	X	X	X
C3	100 µF 10 V Electrolytic	022-123-9-002	X	X	X	X
C4	1 µF 50 V Electrolytic	022-086-9-004	X	X		
C4	0.1 µF 12 V Semiconductor	033-018-9-001			X	X
C5	1 µF 50 V Electrolytic	022-086-9-004	X	X		
C5	2 pF ±0.25% 50 V Ceramic	020-246-9-001			X	X
C6	1 µF 50 V Electrolytic	022-086-9-004	X	X		
C6	1 µF 50 V Electrolytic	022-086-9-004			X	X
C7	0.01 µF ±5% 50 V Ceramic	020-142-9-012	X	X		
C7	1 µF 50 V Electrolytic	022-086-9-004			X	X
C8	0.01 µF ±5% 50 V Ceramic	020-142-9-012	X	X		
C8	1 µF 50 V Electrolytic	002-086-9-004			X	X
C9	33 pF ±5% 50 V Ceramic	020-149-9-005	X	X		
C9	0.01 µF 12 V Semiconductor	033-018-9-001			X	X
C10	0.47 µF ±1% Metal Film	033-019-9-003	X	X		
C10	47 µF 10 V Electrolytic	022-119-9-004			X	X
C11	0.0047 µF ±1 Metal Film	033-019-9-004	X	X		
C11	220pF ±5% 50 V Ceramic	020-103-9-001			X	X
C12	39 pF ±5% 50 V Ceramic	020-171-9-006	X	X		
C12	220 µF ±5% 10 V Electrolytic	022-126-9-001			X	X
C13	18 pF ±5% 50 V Ceramic	020-149-9-002	X			

Code: 1 = Model 1474, 2 = Model 1479, 3 = Model 1479A, 4 = Model 1479B

INDEX NUMBER	DESCRIPTION	B & K-PRECISION PART NUMBER	1	2	3	4
C13	10 pF ±5% 50 V Ceramic	020-215-9-001		X		
C13	0.01 µF ±5% 50 V Ceramic	020-296-9-001			X	X
C14	22 µF 35 V Tantalum	027-050-9-001	X	X		
C14	0.01 µF 12 V Semiconductor	033-018-9-001			X	X
C15	2200 pF Mylar	025-107-9-006	X	X		
C15	0.01 µF 12 V Semiconductor	033-018-9-001			X	X
C16	560 pF ±5% 50 V Ceramic	020-171-9-009	X	X		
C16	0.01 µF 12 V Semiconductor	033-018-9-001			X	X
C17	5 pF ±5% 50 V Ceramic	020-124-9-006	X	X		
C17	0.01 µF ±5% 50 V Ceramic	020-296-9-001			X	X
C18	18 pF ±5% 50 V Ceramic	020-242-9-001	X	X		
C18	10 pF ±5% 50 v Ceramic	020-096-9-004			X	X
C19	1500 pF ±5% 50 V Mylar	025-107-9-003	X	X		
C19	33 pF ±5% 50 V Ceramic	020-238-9-001			X	X
C20	1500 pF ±5% 50 V Mylar	025-107-9-005	X	X		
C20	0.01 µF 12 V Semiconductor	033-018-9-001			X	X
C21	150 pF ±5% 50 V Ceramic	020-171-9-008	X			
C21	680 pF ±5% 50 V Ceramic	020-200-9-003		X		
C21	2200 pF ±5% 50 V Ceramic	020-296-9-004			X	X
C22	150 pF ±5% 50 V Ceramic	020-171-9-008	X			
C22	270 pF ±5% 50 V Ceramic	020-237-9-001		X		
C22	0.47 µF ±1% Metal Film	033-019-9-003			X	X
C23	1 pF ±5% 500 V Ceramic	020-171-9-005	X	X		
C23	0.0047 µF ±1% Metal Film	033-019-9-004			X	X
C24	4700 pF ±5% 500 V Ceramic	020-171-9-001	X	X		
C24	39 pF ±5% 50 V Ceramic	020-238-9-001			X	
C24	33 pF ±5% 50 V Ceramic	020-238-9-001				X
C25	100 pF ±5% 500 V Ceramic	020-171-9-001	X	X		
C25	10 pF ±5% 50 V Ceramic	020-215-9-001			X	X
C26	15 pF µ5% 50 V Ceramic	020-096-9-005	X	X		
C26	5 pF ±0.25% 50 V Ceramic	020-246-9-002			X	X
C27	3300 pF ±5% 500 V Ceramic	020-149-9-004	X	X		
C27	22 µF ±5% 35 V Tantalum	027-050-9-001			X	X
C28	1 µF 50 V Electrolytic	034-006-9-001	X	X		
C28	22 µF ±5% 35 V Tantalum	027-050-9-001			X	X
C29	1 µF 50 V Electrolytic	034-006-9-001	X	X		
C29	2200 pF 50 V Mylar	025-107-9-006			X	X
C30	10 pF ±5% 50 V Ceramic	020-144-9-002	X			
C30	47 pF ±5% 50 V Ceramic	020-144-9-004		X		
C30	1000 pF ±5% 50 V Ceramic	020-296-9-002			X	X
C31	0.01 µF ±5% 50 V Ceramic	020-142-9-012	X	X		
C31	150 pF ±5% 50 V Ceramic	020-171-9-008			X	X
C32	0.01 µF ±5% 50 V Ceramic	020-142-9-012	X	X		
C32	18 pF ±5% 50 V Ceramic	020-149-9-002			X	X
C33	0.01 µF ±5% 50 V Ceramic	020-142-9-012	X	X		
C33	1500 pF 50 V Mylar	025-107-9-005			X	X
C34	0.01 µF ±5% 50 V Ceramic	020-142-9-012	X	X		
C34	1500 pF 50 V Mylar	025-107-9-005			X	X
C35	15 pF µ5% 50 V Ceramic	020-096-9-005	X	X		

Code: 1 = Model 1474, 2 = Model 1479, 3 = Model 1479A, 4 = Model 1479B

INDEX NUMBER	DESCRIPTION	B & K-PRECISION PART NUMBER	1	2	3	4
C35	1500 pF ±5% 50 V Ceramic	020-269-9-003			X	X
C36	3 pF ±5% 50 V Ceramic	020-171-9-004	X	X		
C36	680 pF ±5% 50 V Ceramic	020-200-9-003			X	X
C37	33 pF ±5% 50 V Ceramic	020-149-9-005	X	X		
C38	1000 pF 500 V ±20% Ceramic	020-171-9-010	X	X		
C38	100 pF 50 V ±5% Ceramic	020-142-9-007			X	X
C39	100 µF 10 V ±10% Electrolytic	022-123-9-002	X	X		
C39	0.015 µF 50 V ±10% Mylar	025-162-9-001			X	X
C40	470 µF 10 V Electrolytic	022-073-9-003	X	X		
C40	100 pF 500 V ±5% Ceramic	020-171-9-007			X	X
C41	470 µF 10 V Electrolytic	022-073-9-003	X	X		
C41	15 pF 50 V ±5% Ceramic	020-096-9-005			X	X
C42	2200 pF 50 V ±20% Cermaic	020-096-9-008	X	X		
C42	3300 pF 500 V ±20% Ceramic	020-296-9-006			X	X
C43	47 µF 10 V Electrolytic	022-119-9-004	X	X		
C43	0.01 µF 12 V Semiconductor	033-018-9-001			X	X
C44	2200 pF 50 V ±20% Cermaic	020-096-9-008	X	X		
C44	0.01 µF ±5% 50 V ±20% Ceramic	020-296-9-001			X	X
C45	2200 pF 50 V ±20% Ceramic	020-096-9-008	X			
C45	0.01 µF 12 V Semiconductor	033-018-9-001			X	X
C46	4.7 pF 50 V ±5% Ceramic	020-103-9-003			X	X
C47	680 pF ±5% 50 V ±10% Ceramic	020-200-9-003		X		
C47	1 µF 50 V ±20% Electrolytic	022-167-9-001			X	X
C48	10 pF 50 V ±0.5 pF Ceramic	022-167-9-001		X		
C48	1 µF 50 V ±20% Electrolytic	022-167-9-001			X	X
C49	220 pF 50 V ±5% Ceramic	020-124-9-008		X		
C49	0.01 µF 12 V Semiconductor	033-018-9-001			X	X
C50	2 pF 50 V ±0.5 pF Ceramic	020-169-9-001		X		
C50	0.01 µF ±5% 50 V Ceramic	020-296-9-001			X	X
C51	0.01 µF ±5% 50 V Ceramic	020-296-9-001			X	X
C52	0.1 µF 12 V Ceramic	033-018-9-001		X		
C52	47 pF 50 V ±5% Ceramic	020-103-9-003			X	
C52	15 pF 50 V ±5% Ceramic	020-069-9-005				X
C53	0.1 µF 12 V Ceramic	033-018-9-001		X		
C53	2 pF ±0.25% 50 V Cremaic	020-246-9-001			X	X
C54	0.1 µF 12 V Ceramic	033-018-9-001		X		
C54	2 pF ±0.25% 50 V Cremaic	020-246-9-001			X	X
C55	0.1 µF 12 V Ceramic	033-018-9-001		X		
C55	0.01 µF ±5% 50 V Ceramic	020-296-9-001			X	X
C56	0.1 µF 12 V Ceramic	033-018-9-001		X		
C56	1 µF 50 V ±20% Electrolytic	022-167-9-001			X	X
C57	1000 pF 50 V ±20% Ceramic	020-234-9-002		X		
C57	100 µF 10 V Electrolytic	022-123-9-002			X	X
C58	5 pF 50 V ±0.5 pF Ceramic	020-124-9-006		X		
C58	0.01 µF 50 V Mylar	025-141-9-001			X	X
C59	22 pF 50 V ±5% Ceramic	020-124-9-007		X		
C59	0.01 µF ±5% 50 V Ceramic	020-296-9-001			X	X
C60	0.1 µF 12 V ±20% Ceramic	033-018-9-001		X		
C60	0.01 µF ±5% 50 V Ceramic	020-296-9-001			X	X

Code: 1 = Model 1474, 2 = Model 1479, 3 = Model 1479A, 4 = Model 1479B

INDEX NUMBER	DESCRIPTION	B & K-PRECISION PART NUMBER	1	2	3	4
C61	15 pF 50 V ±5% Ceramic	020-096-9-005			X	X
C62	0.01 µF ±5% 50 V Ceramic	020-296-9-001			X	X
C63	0.01 µF ±5% 50 V Ceramic	020-296-9-001			X	X
C64	33 pF 50 V ±5% Ceramic	020-238-9-001			X	
C64	5 pF 50 V Ceramic	02-233-9-002				X
C65	0.01 µF ±5% 50 V Ceramic	020-296-9-001			X	X
C66	0.01 µF 12 V Semiconductor	033-018-9-001			X	X
C67	220pF ±5% 50 V Ceramic	020-103-9-001			X	X
C68	220pF ±5% 50 V Ceramic	020-103-9-001			X	X
C69	1000 pF 500 V ±20% Ceramic	020-296-9-005			X	X
C70	150 pF ±5% 50 V Ceramic	020-171-9-008			X	X
C71	470 pF 50 V ±5% Ceramic	020-233-9-003				X
C72	100 µF 10 V Electrolytic	022-123-9-002			X	X
C73	470 µF 10 V ±20% Electrolytic	022-226-9-006			X	X
C74	0.01 µF 12 V Semiconductor	033-018-9-001			X	X
C75	470 µF 10 V ±20% Electrolytic	022-226-9-006			X	X
C76	0.01 µF 12 V Semiconductor	033-018-9-001			X	X
C77	47 µF 10 V Electrolytic	022-119-9-004			X	X
TC1	20 pF Trimmer	028-039-9-001	X	X		
TC1	20 pF Trimmer	028-050-9-002			X	X
TC2	10 pF Trimmer	028-033-9-002	X	X		
TC2	10pF Trimmer	028-050-9-003			X	X
TC3	6 pF Trimmer	028-033-9-001		X		
TC3	6 pF Trimmer	028-050-9-001			X	X
TC4	6 pF Trimmer	028-033-9-001		X		
TC4	6 pF Trimmer	028-050-9-001			X	X
	DIODES					
D1	1N60 Diode Germanium	150-011-9-005	X	X	X	X
D2	1S1555 Diode Silicon	101-028-9-009	X	X	X	X
D3	1S1555 Diode Silicon	101-028-9-009	X	X	X	X
D4	1S1555 Diode Silicon	101-028-9-009	X	X	X	X
D5	1N60 Diode Germanium	150-011-9-005	X	X	X	X
D6	1S1587 Diode Silicon	151-048-9-001	X	X	X	X
D7	1S1555 Diode Silicon	101-028-9-009	X	X	X	X
D8	1S1555 Diode Silicon	101-028-9-009	X	X	X	X
D9	1S1555 Diode Silicon	101-028-9-009	X	X	X	X
D10	1S1555 Diode Silicon	101-028-9-009	X	X	X	X
D11	1N60 Diode Germanium	150-001-9-005	X	X		
D11	1S1555 Diode Silicon	101-028-9-009			X	X
D12	1N60 Diode Germanium	150-001-9-005	X	X		
D12	1S1555 Diode Silicon	101-028-9-009			X	X
D13	1N60 Diode Germanium	150-001-9-005	X	X		
D13	1S1555 Diode Silicon	101-028-9-009			X	X
D14	1N60 Diode Germanium	150-001-9-005	X	X		
D14	1S1555 Diode Silicon	101-028-9-009			X	X
D15	1S1555 Diode Silicon	101-028-9-009	X	X		
D15	1N60 Diode Germanium	150-001-9-005			X	X

Code: 1 = Model 1474, 2 = Model 1479, 3 = Model 1479A, 4 = Model 1479B

INDEX NUMBER	DESCRIPTION	B & K-PRECISION PART NUMBER	1	2	3	4
D16	WZ-081 Diode Zener	152-054-9-001	X			
D16	YZ-030 Diode Zener	152-099-9-002		X		
D16	1S1555 Diode Silicon	101-028-9-009			X	X
D17	1S1555 Diode Silicon	101-028-9-009	X	X	X	X
D18	1S1555 Diode Silicon	101-028-9-009	X	X		
D18	1N60 Diode Germanium	150-001-9-005			X	X
D19	1S1555 Diode Silicon	101-028-9-009	X	X		
D19	1N60 Diode Germanium	150-001-9-005			X	
D20	1S1555 Diode Silicon	151-028-9-007				
D20	1N60 Diode Germanium	150-001-9-005			X	
D21	1N60 Diode Germanium	150-001-9-002		X		
D21	1S1555 Diode Silicon	101-028-9-009			X	X
D22	1S1555 Diode Silicon	151-028-9-007				
D22	1S1555 Diode Silicon	101-028-9-009			X	X
D23	YZ-030 Diode Zener	152-099-9-002			X	X
D24	1S1555 Diode Silicon	101-028-9-009			X	X
D25	1S1555 Diode Silicon	101-028-9-009			X	X
D26	1S1555 Diode Silicon	101-028-9-009			X	X
	TRANSISTORS					
Q1	2SC458C Transistor NPN	176-016-9-001	X	X		
Q1	2SC945P Transistor NPN	176-055-9-002			X	X
Q2	2SC458C Transistor NPN	176-016-9-001	X	X		
Q2	2SC945P Transistor NPN	176-055-9-002			X	X
Q3	2SC458C Transistor NPN	176-016-9-001	X	X		
Q3	2SC945P Transistor NPN	176-055-9-002			X	X
Q4	2SC458C Transistor NPN	176-016-9-001	X	X		
Q4	2SC945P Transistor NPN	176-055-9-002			X	X
Q5	2SC458C Transistor NPN	176-016-9-001	X	X		
Q5	2SC945P Transistor NPN	176-055-9-002			X	X
Q6	2SC458C Transistor NPN	176-016-9-001	X	X		
Q6	2SC945P Transistor NPN	176-055-9-002			X	X
Q7	2SC945P Transistor NPN	176-055-9-002			X	X
Q7	2SA733Q Transistor PNP	177-018-9-001	X	X		
Q8	2SA733Q Transistor PNP	177-018-9-001	X	X	X	X
Q9	2SC458C Transistor NPN	176-016-9-001	X	X		
Q9	2SA733Q Transistor PNP	171-018-9-001			X	X
Q10	2SK30AQ FET	182-026-9-001	X	X		
Q10	2SC945P Transistor NPN	176-055-9-002			X	X
Q11	2SC458C Transistor NPN	176-016-9-001	X	X		
Q11	2SK30AQ FET	182-026-9-001			X	X
Q12	2SK30AQ FET	182-026-9-001	X	X		
Q12	2SC945P Transistor NPN	176-055-9-002			X	X
Q13	2SC458C Transistor NPN	176-016-9-001	X	X		
Q13	2SK30AQ FET	182-026-9-001			X	X
Q14	2SC458C Transistor NPN	176-016-9-001	X	X		
Q14	2SC945P Transistor NPN	176-055-9-002			X	X
Q15	2SC458C Transistor NPN	176-016-9-001	X	X		
Q15	2SC945P Transistor NPN	176-055-9-002			X	

Code: 1 = Model 1474, 2 = Model 1479, 3 = Model 1479A, 4 = Model 1479B

INDEX NUMBER	DESCRIPTION	B & K-PRECISION PART NUMBER	1	2	3	4
Q15	2SK185-2-M FET	182-058-9-001				X
Q16	2SC458C Transistor NPN	176-016-9-001	X	X		
Q16	2SC945P Transistor NPN	176-055-9-002			X	X
Q17	2SC458C Transistor NPN	176-016-9-001	X	X		
Q17	2SC945P Transistor NPN	176-055-9-002			X	X
Q18	2SC458C Transistor NPN	176-016-9-001	X	X		
Q18	2SK30AQ FET	182-026-9-001			X	X
Q19	2SC458C Transistor NPN	176-016-9-001	X	X		
Q19	2SC945P Transistor NPN	176-055-9-002			X	X
Q20	2SC458C Transistor NPN	176-016-9-001	X			
Q20	2SC535C Transistor NPN	176-055-9-001		X		
Q20	2SC945P Transistor NPN	176-055-9-002			X	X
Q21	2SC458C Transistor NPN	176-016-9-001	X	X		
Q21	2SK30AQ FET	182-026-9-001			X	X
Q22	2SC458C Transistor NPN	176-016-9-001	X	X		
Q22	2SA733Q Transistor PNP	171-018-9-001			X	X
Q23	2SC1507 Transistor NPN	176-055-9-001	X	X		
Q23	2SC945P Transistor NPN	176-055-9-002			X	X
Q24	2SC1507 Transistor NPN	176-055-9-001	X	X		
Q24	2SC535C Transistor NPN	176-055-9-001			X	X
Q25	2SC458C Transistor NPN	176-016-9-007		X		
Q25	2SC945P Transistor NPN	176-055-9-002			X	X
Q26	2SC945P Transistor NPN	176-055-9-002			X	X
Q27	2SC945P Transistor NPN	176-055-9-002			X	X
Q28	2SC945P Transistor NPN	176-055-9-002			X	X
Q29	2SC945P Transistor NPN	176-055-9-002			X	X
Q30	2SC945P Transistor NPN	176-055-9-002			X	X
Q31	2SC1507 Transistor NPN	176-055-9-006			X	X
Q32	2SC1507 Transistor NPN	176-055-9-006			X	X
Q33	2SC945P Transistor NPN	176-055-9-002				X
Q34	2SA733Q Transistor PNP	077-018-9-001				X
	INTEGRATED CIRCUITS					
IC1	SN74H00N Digital I.C.	307-106-9-002	X	X	X	X
IC2	SN74H72N Digital I.C.	307-106-9-003	X	X	X	X
IC3	RC555DN Linear I.C.	307-094-9-001	X			
IC3	NJM555D Linear I.C.	307-171-9-001		X	X	X
IC4	SN7400N Digital I.C.	307-106-9-004	X	X	X	X
IC5	RC733T Linear I.C.	307-069-9-001	X	X	X	X
IC6	SN74LS00N Digital I.C.	307-139-9-002			X	X
IC7	SN74LS00N Digital I.C.	307-139-9-002			X	X
	INDUCTORS					
L1	47 µH Ferri-Inductor	041-068-9-002	X	X		
L1	3.9 µH Ferri-Inductor	041-122-9-001			X	
L1	Fixed Ferri-Inductor	041-082-9-001				X
L2	47 µH Ferri-Inductor	041-068-9-002	X	X		
L2	150 µH Ferri-Inductor	014-082-9-003			X	X
L3	Fixed Ferri-Inductor	041-068-9-008	X			

Code: 1 = Model 1474, 2 = Model 1479, 3 = Model 1479A, 4 = Model 1479B

INDEX NUMBER	DESCRIPTION	B & K-PRECISION PART NUMBER	1	2	3	4
L3	3.9 µH Ferri-Inductor	041-122-9-001		X		
L3	40 µH Ferri-Inductor	014-068-9-002			X	X
L4	150 µH Ferri-Inductor	041-082-9-003	X	X		
L4	150 µH Ferri-Inductor	014-082-9-003			X	X
L5	150 µH Ferri-Inductor	041-082-9-003	X	X		
L5	150 µH Ferri-Inductor	014-082-9-003			X	X
L6	47 µF Ferri-Inductor	041-068-9-002	X	X		
L6	40 µH Ferri-Inductor	014-068-9-002			X	X
L7	47 µF Ferri-Inductor	041-068-9-002	X	X		
L7	40 µH Ferri-Inductor	014-068-9-002			X	X
L8	47 µF Ferri-Inductor	041-068-9-002	X	X		
L8	100 µH Ferri-Inductor	041-124-9-001			X	X
L9	40 µH Ferri-Inductor	014-068-9-002			X	X
L10	330 µH Ferri-Inductor	041-113-9-001			X	X
	SWITCHES					
S2	Rotary (Sweep Time/Div)	083-212-9-002	X	X	X	X
S3	Lever (Source)	080-004-9-002	X	X	X	X
S4	Lever (Coupling)	080-004-9-002	X	X	X	X
S5	Lever (Slope)	080-004-9-001	X	X	X	X

Code: 1 = Model 1474, 2 = Model 1479, 3 = Model 1479A, 4 = Model 1479B

INDEX NUMBER	DESCRIPTION	B & K-PRECISION PART NUMBER	1	2	3	4
	POWER SUPPLY BOARD					
	RESISTORS					
	Unlisted resistors are ±5%, 1/4 W. See schematic diagram for value.					
R302	8.2 MΩ 1 W ±1% Metal Film	004-171-9-001	X	X	X	X
R315	1.6 KΩ 1/4 ±1% Metal Film	013-013-9-026	X			
R315	130 KΩ 1/4 ±1% Metal Film	015-141-1-303		X	X	X
R338	4.3 KΩ 1.4 ±1% Metal Film	013-010-9-005	X	X	X	X
R339	8.2 KΩ 1/4 ±1% Metal Film	013-010-9-007	X	X	X	X
R341	15 KΩ 1/4 ±1% Metal Film	013-013-9-024	X	X	X	X
R342	12 KΩ 1/4 ±1% Metal Film	013-013-9-023	X	X	X	X
R344	8.2 KΩ 1/4 ±1% Metal Film	013-010-9-007	X			
R344	68 KΩ 1/4 ±1% Metal Film	013-010-9-006		X	X	X
R348	91 KΩ 1/4 ±1% Metal Film	013-013-9-025	X	X	X	
R353	1 KΩ 2 ±1% Metal Film	011-002-5-102	X			
R353	510 Ω 1 ±1% Metal Film	011-002-9-511		X	X	X
VR301	100 KΩ Potentiometer	008-155-9-001	X	X	X	X
VR302	47 KΩ Potentiometer	008-155-9-003	X	X	X	X
VR303	47 KΩ Potentiometer	008-298-9-012	X	X	X	X
VR304	1 KΩ Potentiometer	008-155-9-005	X	X	X	X
	CAPACITORS					
C301	4700 pF 2000 V +100,-0% Ceramic	020-124-9-004	X	X	X	
C302	3300 pF 3150 V +100,-0% Ceramic	020-171-9-012	X	X	X	
C303	3300 pF 3150 V +100,-0% Ceramic	020-171-9-012	X	X	X	
C304	1000 pF 2000 V +100,-0% Ceramic	020-163-9-005	X	X	X	X
C305	0.01 µF 2000 V +100,-0% Ceramic	020-124-9-011	X	X	X	X
C306	0.01 µF 2000 V +100,-0% Ceramic	020-124-9-011	X	X	X	X
C307	0.01 µF 2000 V +100,-0% Ceramic	020-124-9-011	X	X	X	X
C308	0.01 µF 2000 V +100,-0% Ceramic	020-124-9-011	X	X	X	X
C309	0.01 µF 50 V +80,-20% Ceramic	020-245-9-001	X	X	X	X
C310	470 µF 50 V Electrolytic	022-135-9-003	X	X	X	X
C311	0.022 µF 50 V ±10% Mylar	025-107-9-002	X			
C311	0.015 µF 50 V ±10% Mylar	025-161-9-001		X	X	X
C312	0.1 µF 50 V Ceramic	033-018-9-001	X	X	X	
C312	0.1 µF 50 V Metal Film	033-058-9-001				X
C313	3.3 µF 250 V Electrolytic	021-061-9-003	X	X	X	X
C314	150 pF 50 V ±5% Ceramic	020-171-9-008	X			
C314	220 pF 50 V ±5% Ceramic	020-124-9-008		X	X	X
C315	1 pF 500 V ±0.5 pF Ceramic	020-171-9-001	X			
C315	2 pF 500 V ±0.5 pF Ceramic	020-171-9-003		X	X	X
C316	0.1 µF 50 V Ceramic	033-018-9-001	X	X	X	
C316	0.1 µF 50 V Ceramic	033-018-9-001				X
C317	10 pF 50 V ±0.5 pF Ceramic	020-142-9-003	X	X	X	X
C318	3300 pF 500 V ±20% Ceramic	020-149-9-004	X	X	X	X

Code: 1 = Model 1474, 2 = Model 1479, 3 = Model 1479A, 4 = Model 1479B

INDEX NUMBER	DESCRIPTION	B & K-PRECISION PART NUMBER	1	2	3	4
C319	0.01 µF 500 V ±20% Ceramic	020-111-9-002	X	X	X	X
C320	0.01 µF 500 V ±20% Ceramic	020-111-9-002	X	X	X	X
C321	0.01 µF 500 V ±20% Ceramic	020-111-9-002	X	X	X	X
C322	0.1 µF 50 V Ceramic	033-018-9-001	X	X	X	
C322	0.1 µF 50 V Ceramic	033-018-9-001				X
C323	330 µF 10 V Electrolytic	022-149-9-001	X	X	X	X
C324	0.1 µF 50 V Ceramic	033-018-9-001	X	X	X	
C324	0.1 µF 50 V Ceramic	033-018-9-001				X
C325	220 µF 16 V Electrolytic	022-086-9-002	X	X	X	X
C326	3300 µF 25 V Electrolytic	022-149-9-003	X	X	X	X
C327	2200 µF 25 V Electrolytic	022-149-9-002	X	X	X	X
C328	100 µF 25 V Electrolytic	022-123-9-001	X	X	X	X
C329	100 µF 50 V Electrolytic	022-073-9-007	X	X	X	X
C330	330 µF 10 V Electrolytic	022-149-9-001	X	X	X	X
C331	0.1 µF 50 V Ceramic	033-018-9-001	X	X	X	
C331	0.1 µF 50 V Ceramic	033-018-9-001				X
C332	0.01 µF 500 V ±20% Ceramic	020-111-9-002	X	X	X	X
C333	0.01 µF 500 V ±20% Ceramic	020-111-9-002	X	X	X	X
C334	10 µF 160 V Electrolytic	021-061-9-001	X	X	X	X
C335	100 µF 160 V Electrolytic	021-061-9-002	X	X	X	X
C336	33 µF 25 V Electrolytic	022-135-9-001	X	X	X	X
C337	10 µF 160 V Electrolytic	021-061-9-001	X	X	X	X
C338	0.01 µF 2000 V +100,-0% Ceramic	020-124-9-011	X	X	X	X
C339	0.1 µF 50 V Ceramic	033-018-9-001	X	X	X	
C339	0.1 µF 50 V Ceramic	033-018-9-001				X
C340	0.1 µF 50 V Ceramic	033-018-9-001	X	X	X	
C340	0.1 µF 50 V Ceramic	033-018-9-001				X
C341	10 µF 25 V Ceramic	022-086-9-005				X
C342	10 µF 25 V Ceramic	022-086-9-005				X
C343	0.1 µF 50 V Ceramic	020-111-9-002				X
C344	0.01 µF 500 V Ceramic	020-111-9-002				X
TC301	10 pF Trimmer	028-033-9-002	X			
TC301	20 pF Trimmer	028-039-9-001		X	X	X
	DIODES					
D301	Diode High Voltage Silicon	151-048-9-003	X	X	X	X
D302	Diode High Voltage Silicon	151-048-9-003	X	X	X	
D302	High Voltage Recifier Network	157-011-9-002				X
D303	Diode High Voltage Silicon	151-048-9-003	X	X	X	
D304	1S2463 Diode Silicon	151-061-9-001	X	X	X	X
D305	1S2463 Diode Silicon	151-061-9-001	X	X	X	X
D306	1S2463 Diode Silicon	151-061-9-001	X	X	X	X
D307	1S1705 Diode Silicon	151-052-9-001	X			
D307	1SS83 Diode Silicon	151-084-9-001		X	X	X
D308	1S1555 Diode Silicon	151-028-9-007	X	X	X	X
D309	1S1555 Diode Silicon	151-028-9-007	X	X	X	X
D310	1S1555 Diode Silicon	151-028-9-007	X	X	X	X
D311	1S1555 Diode Silicon	151-028-9-007	X	X	X	X

Code: 1 = Model 1474, 2 = Model 1479, 3 = Model 1479A, 4 = Model 1479B

INDEX NUMBER	DESCRIPTION	B & K-PRECISION PART NUMBER	1	2	3	4
D312	1S1555 Diode Silicon	151-028-9-007	X	X	X	X
D313	1S1555 Diode Silicon	151-028-9-007	X	X	X	X
D314	1S1555 Diode Silicon	151-028-9-007	X	X	X	X
D315	1S1555 Diode Silicon	151-028-9-007	X	X	X	X
D316	WZ-050 Diode Zener	152-069-9-001	X	X	X	X
D317	WZ-075 Diode Zener	152-076-9-003	X	X	X	X
D318	BZ-310 Diode Zener	152-076-9-002	X			
D318	WZ-150 Diode Zener	152-099-9-003		X		
D319	S1QB60 Bridge Rectifier	157-006-9-001	X	X	X	
D319	S1RBA40 Bridge Rectifier	157-013-9-001				X
D320	S1QB60 Bridge Rectifier	157-006-9-001	X	X	X	X
D321	1S1555 Diode Silicon	151-028-9-007	X	X	X	X
	TRANSISTORS					
Q301	2SD401 Transistor Power NPN	172-037-9-001	X	X	X	X
Q302	2SC983Y Transistor NPN	176-053-9-002	X	X	X	
Q302	2SC2779Y Transistor NPN	176-123-9-001				X
Q303	2SC458C Transistor NPN	176-016-9-001	X	X	X	
Q303	2SC945P Transistor NPN	176-055-9-002				X
Q304	2SC1628Y Transistor NPN	176-055-9-005	X	X	X	X
Q305	2SA818Y Transistor PNP	177-018-9-003	X	X	X	X
Q306	2SC535B Transistor NPN	176-036-9-001	X	X	X	X
Q307	2SC1419C Transistor NPN	176-055-9-004	X	X	X	X
Q308	2SC1419C Transistor NPN	176-055-9-004	X	X	X	X
Q309	2SA755C Transistor PNP	177-018-9-002	X	X	X	
Q309	2SB633E Transistor PNP	173-010-9-001				X
Q310	2SB536(2)LM Transistor PNP	173-004-9-001	X			
Q310	2SB546A Transistor PNP	173-008-9-001		X	X	X
Q311	2SA733Q Transistor PNP	173-018-9-001	X	X	X	X
Q312	2SC945P Transistor NPN	176-055-9-002	X	X	X	X
Q313	2SC945P Transistor NPN	176-055-9-002	X	X	X	X
Q314	2SC945P Transistor NPN	176-055-9-002	X	X	X	X
Q315	SC945P Transistor NPN	176-055-9-002	X	X	X	X
Q316	2SC945P Transistor NPN	176-055-9-002	X	X	X	X
Q317	2SC1384 Transistor NPN	176-109-9-001				X
Q318	2SA684 Transistor PNP	177-046-9-001				X
	INTEGRATED CIRCUITS					
IC301	RC4558T Linear I.C.	307-069-9-005	X	X	X	
IC301	NJM4558T Linear I.C.	307-198-9-001				X
	INDUCTORS					
L301	470 µH Ferri-Inductor	041-071-9-001	X	X	X	X
L302	33 µH Ferri-inductor	041-082-9-004	X	X	X	X
	LAMPS					
N301	Neon Lamp NE-2	401-018-9-001	X	X	X	X
N302	Neon Lamp NE-2	401-018-9-001	X	X	X	X
N303	Neon Lamp NE-2	401-018-9-001		X	X	X

Code: 1 = Model 1474, 2 = Model 1479, 3 = Model 1479A, 4 = Model 1479B

INDEX NUMBER	DESCRIPTION	B & K-PRECISION PART NUMBER	1	2	3	4
	TRANSFORMERS					
T301	Transformer, Converter	064-018-9-001	X	X	X	
T301	Transformer, Converter	064-025-9-001				X
	MISCELLANEOUS					
F301	Fuse 0.5 A (55 mm X 20 mm)	194-006-9-001		X	X	X
TH301	SDT-1000 Thermistor	005-003-9-002		X	X	X

Code: 1 = Model 1474, 2 = Model 1479, 3 = Model 1479A, 4 = Model 1479B

CIRCUIT BOARD MAPS AND SCHEMATIC DIAGRAMS

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Overall Schematic Diagram, Model 1474 106

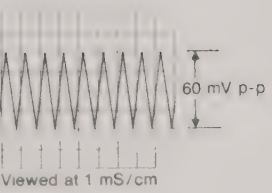
Overall Schematic Diagram, Model 1479 107

Overall Schematic Diagram, Model 1479A 108

Overall Schematic Diagram, Model 1479B 109

TEST CONDITONS (scope under test):
0.6 V p-p, 1 kHz triangle wave input to CH A.
CH A Attenuator = 0.1 V/div
MODE = CH A
SWEEP TIME = 0.5 ms/div

1



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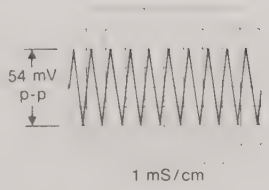
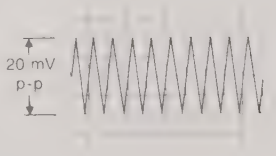


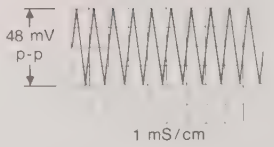
3 Same as **2**

4

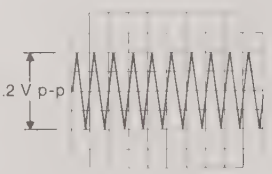


5 Same as **4**

6



7

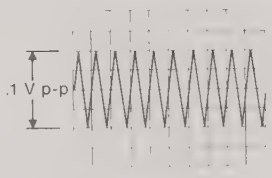


8 Same as **7**

9 Same as **7**

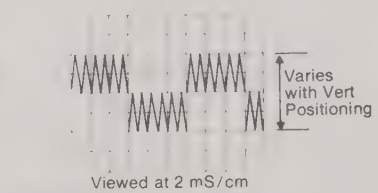
10 Same as **7**

11



12 Same as **11**

12



Test Conditions
.6 V p-p input both CHA & CHB
.1 Volt/cm
Dual Mode

13 Same as **1**

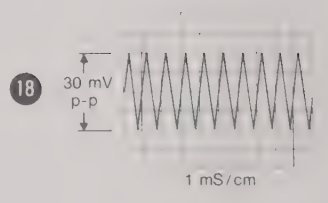
14 Same as **2**

15 Same as **2**

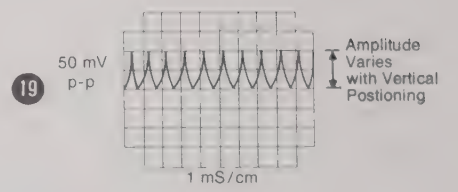
16 Same as **4**

17 Same as **4**

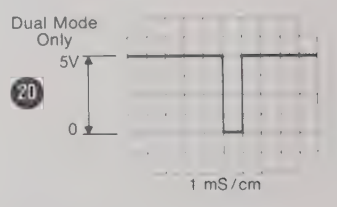
18



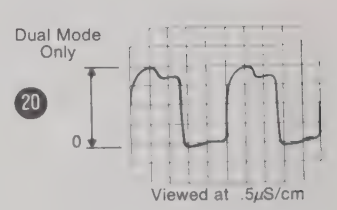
19

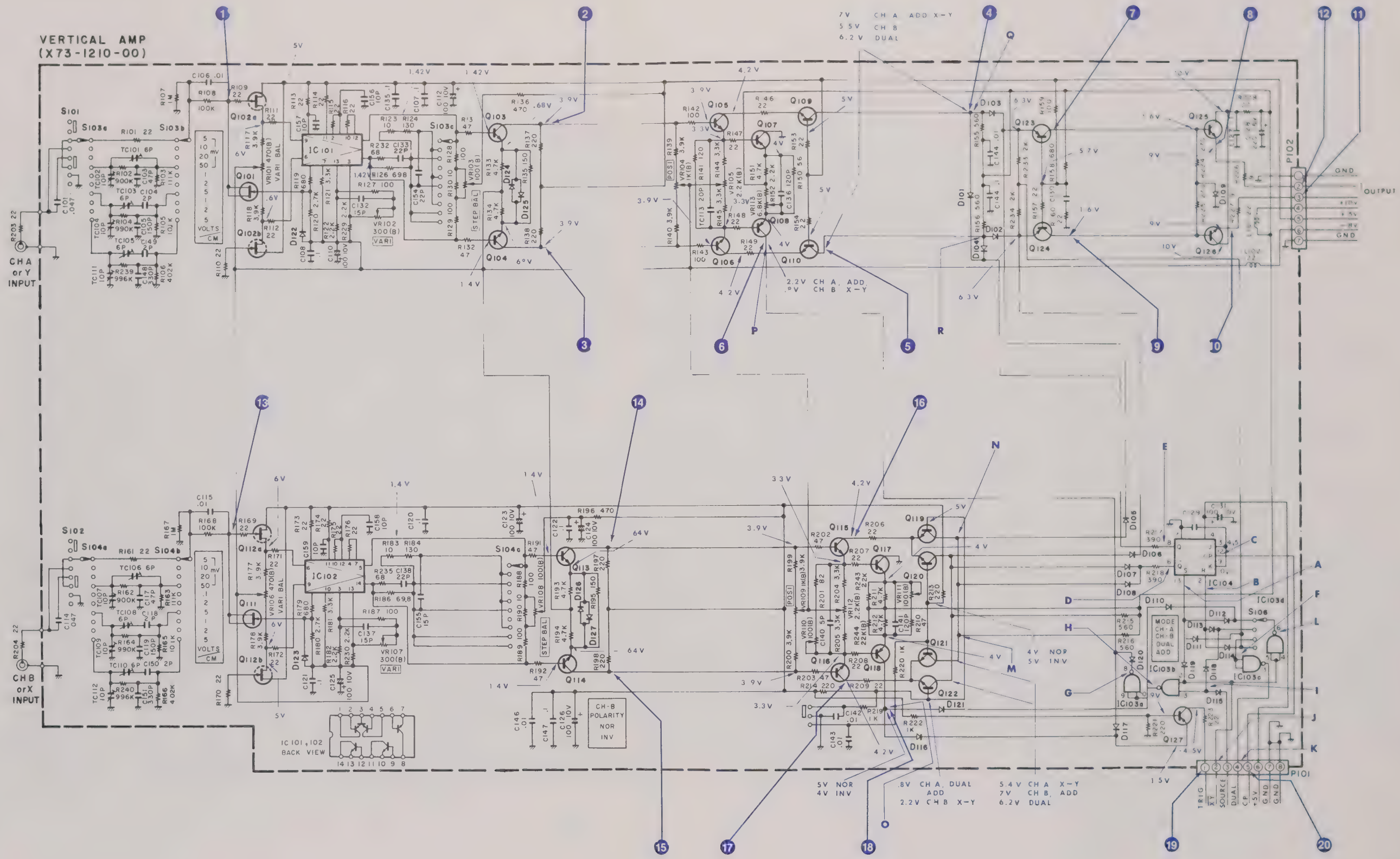


20

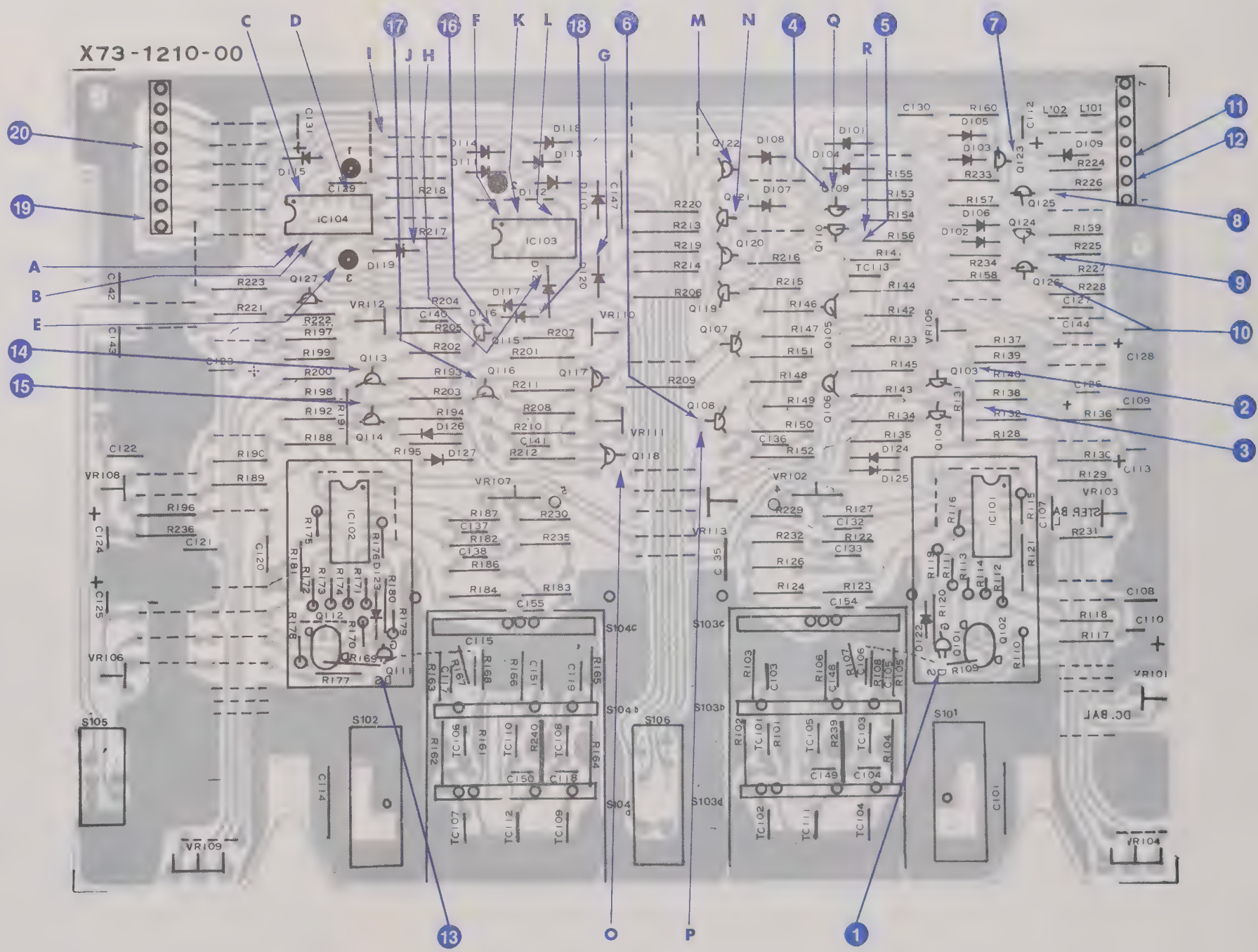


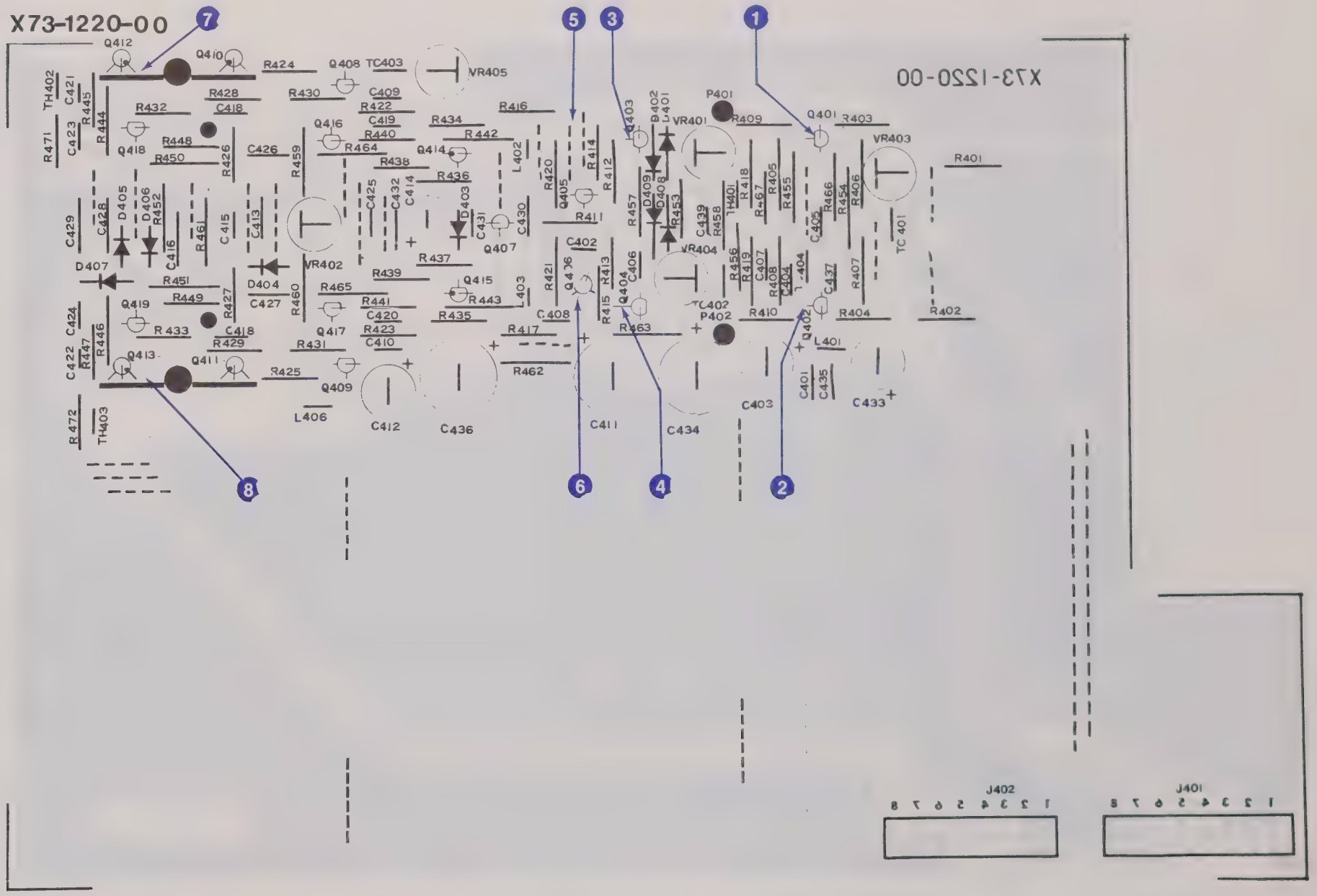
20



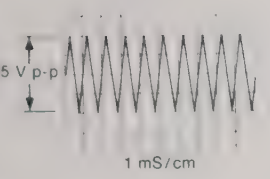

VERTICAL AMP
(X73-1210-00)
CHA or Y INPUT
CHB or X INPUT
S101
S102
S103a
S103b
S103c
S104a
S104b
S104c
IC101
IC102
P102
P101
OUTPUT
GND
+15V
-15V
+5V
TRIG
X-Y
SOURCE
DUAL
CP
GND
7V CH A ADD X-Y
5.5V CH B
6.2V DUAL
2.2V CH A, ADD
.9V CH B X-Y
5V NOR
4V INV
.8V CH A, DUAL ADD
2.2V CH B X-Y
5.4V CH A X-Y
7V CH B, ADD
6.2V DUAL
4V NOR
5V INV
CH-B POLARITY NOR INV
IC101,102 BACK VIEW
MODE
CH-A
CH-B
DUAL
ADD

CIRCUIT BOARD MAP, VERTICAL AMPLIFIER

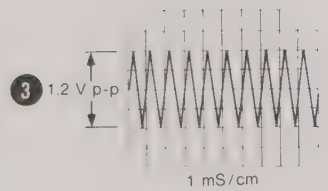



X73-1220-00
7
5
3
1
8
6
4
2
Q412
Q410
R424
Q408
TC403
VR405
P401
VR401
R409
Q401
R403
VR403
R401
TC401
VR404
P402
R410
R404
R402
L401
C403
C433
C434
C411
C436
C412
L406
Q409
R425
Q411
Q413
R462
C408
R463
Q402
C401
C435
R472
TH403
J402
J401
1 2 3 4 5 6 7 8

TEST CONDITONS (scope under test):
0.6 V p-p, 1 kHz triangle wave input to CH A.
CH A Attenuator = 0.1 V/div
MODE = CH A
SWEEP TIME = 0.5 ms/div

1 

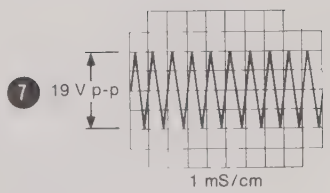
2 Same as 1

3 

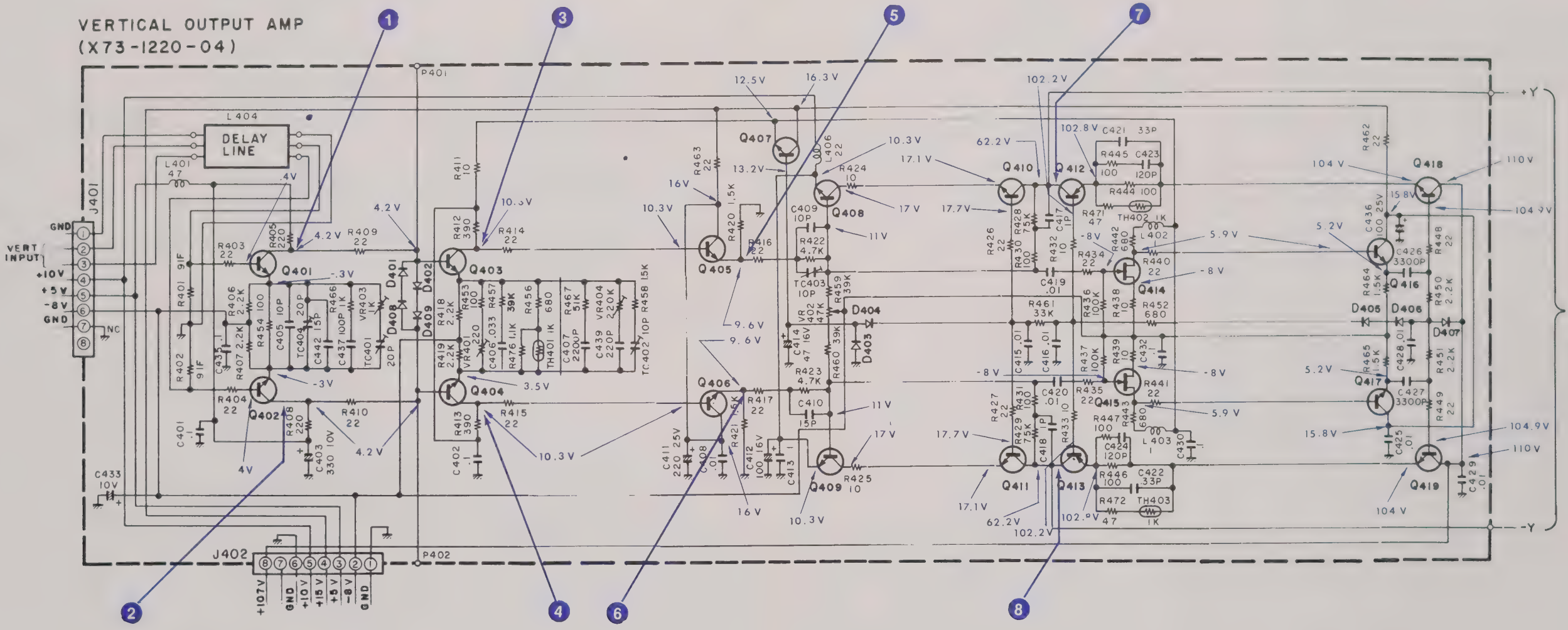
4 Same as 3

5 Same as 3

6 Same as 3

7 

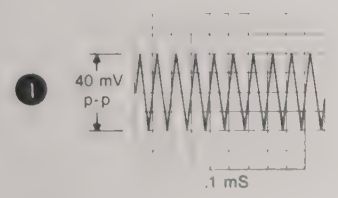
8 Same as 7

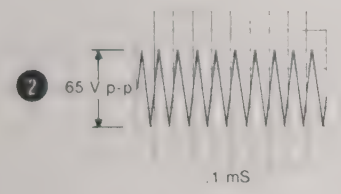


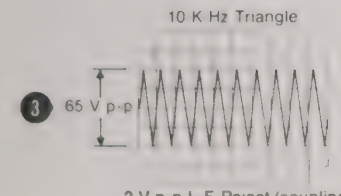
TEST CONDITIONS

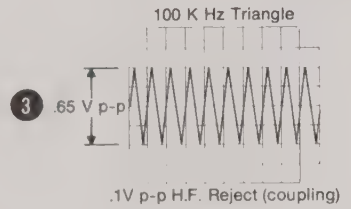
1. .6Vp-p TRIANGLE WAVE 1KHz INPUT TO CHA.
2. .1 VOLT/CM VERT. ATTEN.
3. .5mS/CM SWEEP TIME.
4. CENTERED TRACE.
5. CHA MODE.

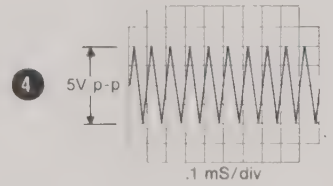
TEST CONDITIONS (unless otherwise specified):
0.6 V p-p, 10 kHz triangle wave input to CH B.
CH B = 0.1 volt/div, AC coupled.
MODE = CH B.
SOURCE = CH B.
SLOPE (+)
Sweep Time (scope under test) = 0.1 ms/div.

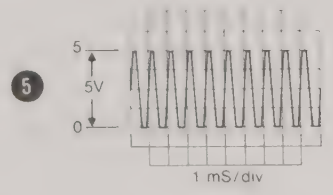


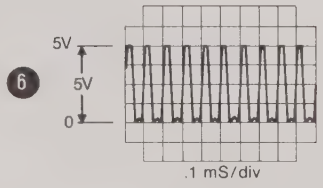


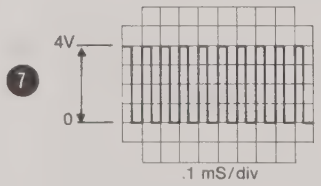


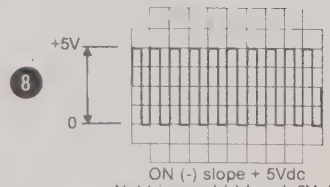


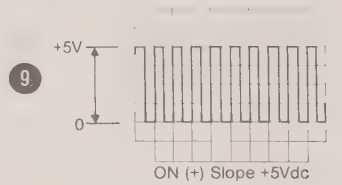


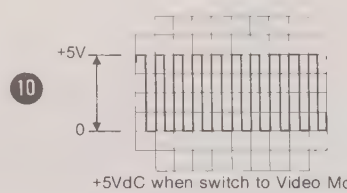


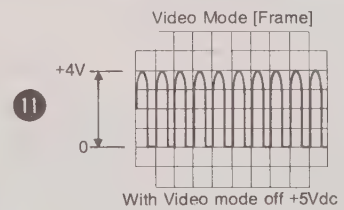






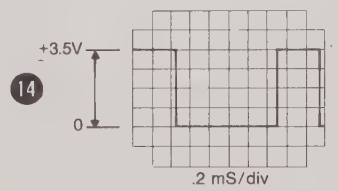




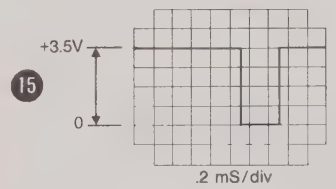


12 Same as 7

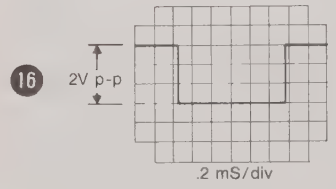
13 Same as 7

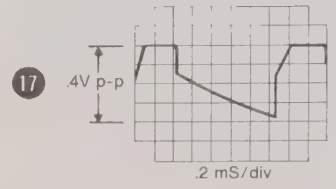


+3.5 V if not triggered

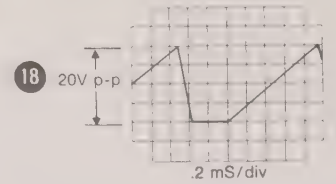


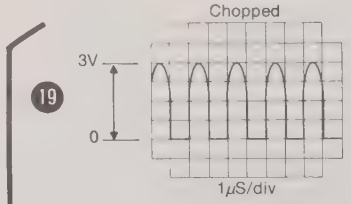
+0.1 V if not triggered

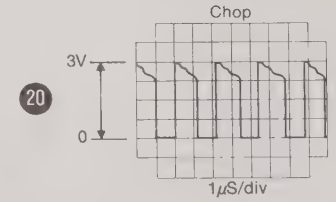


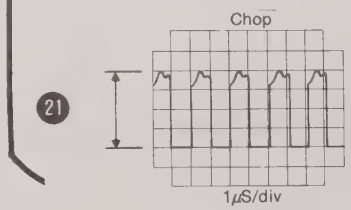


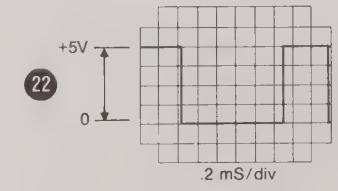
Set Scope Under Test to 1 ms/div

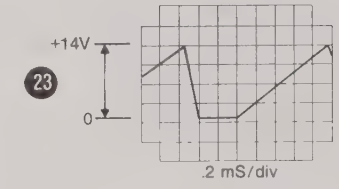


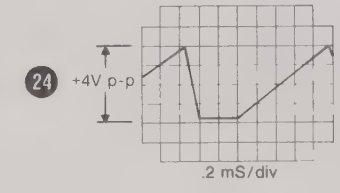


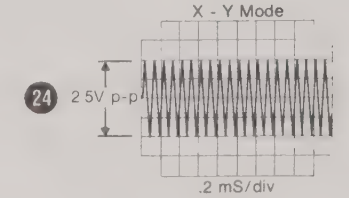




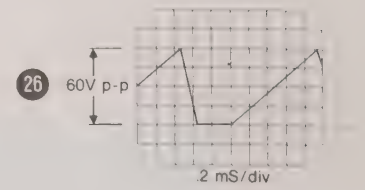


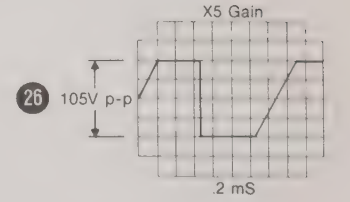


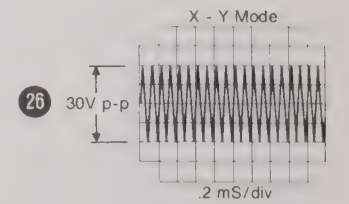


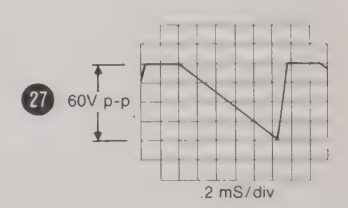


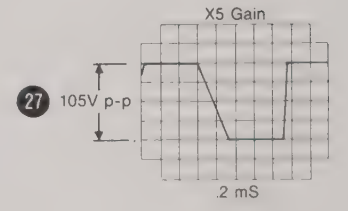
25 Same as 24

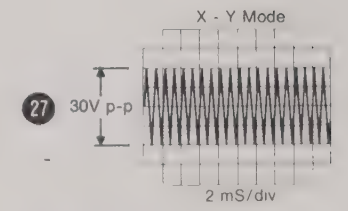




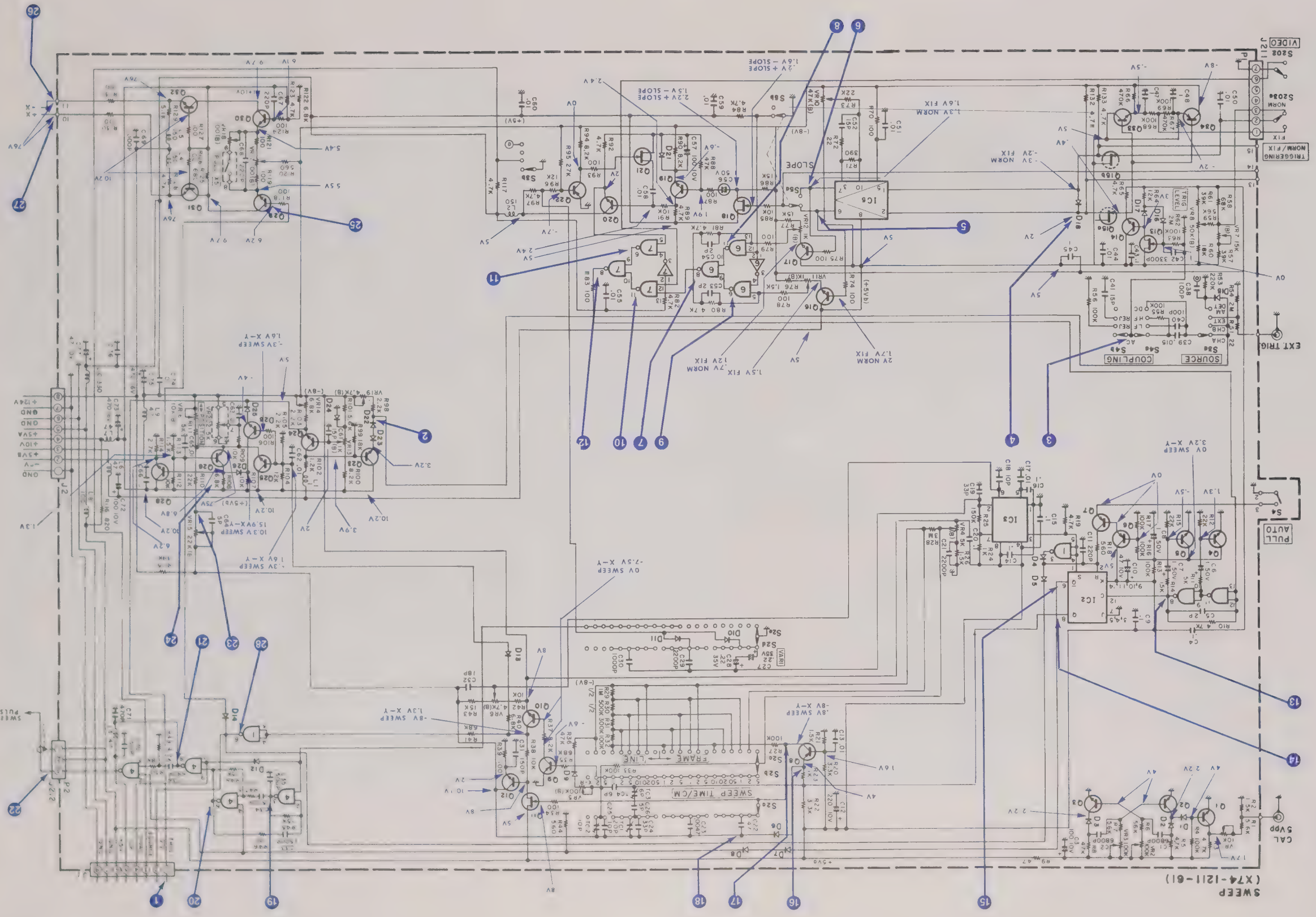




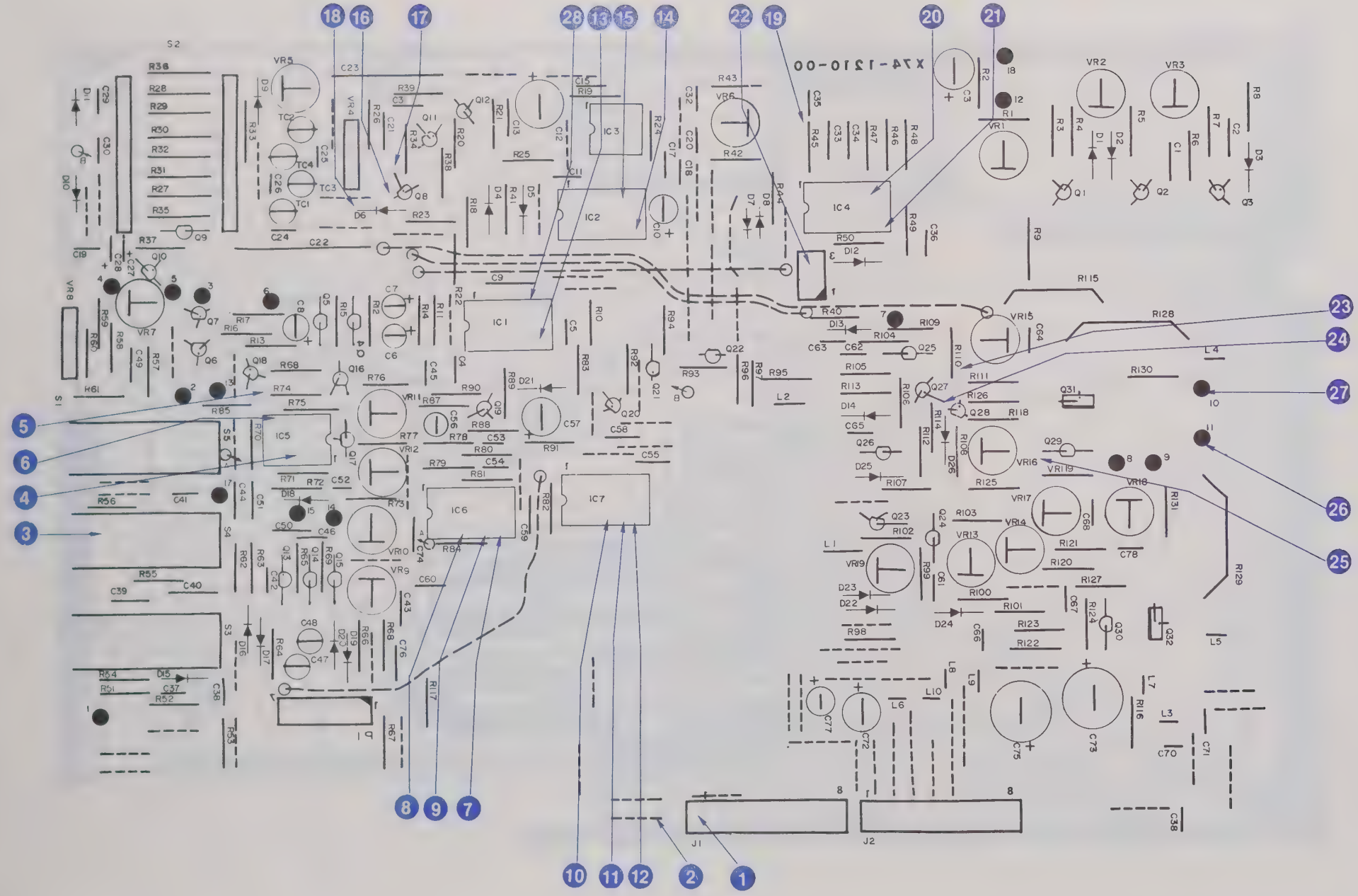


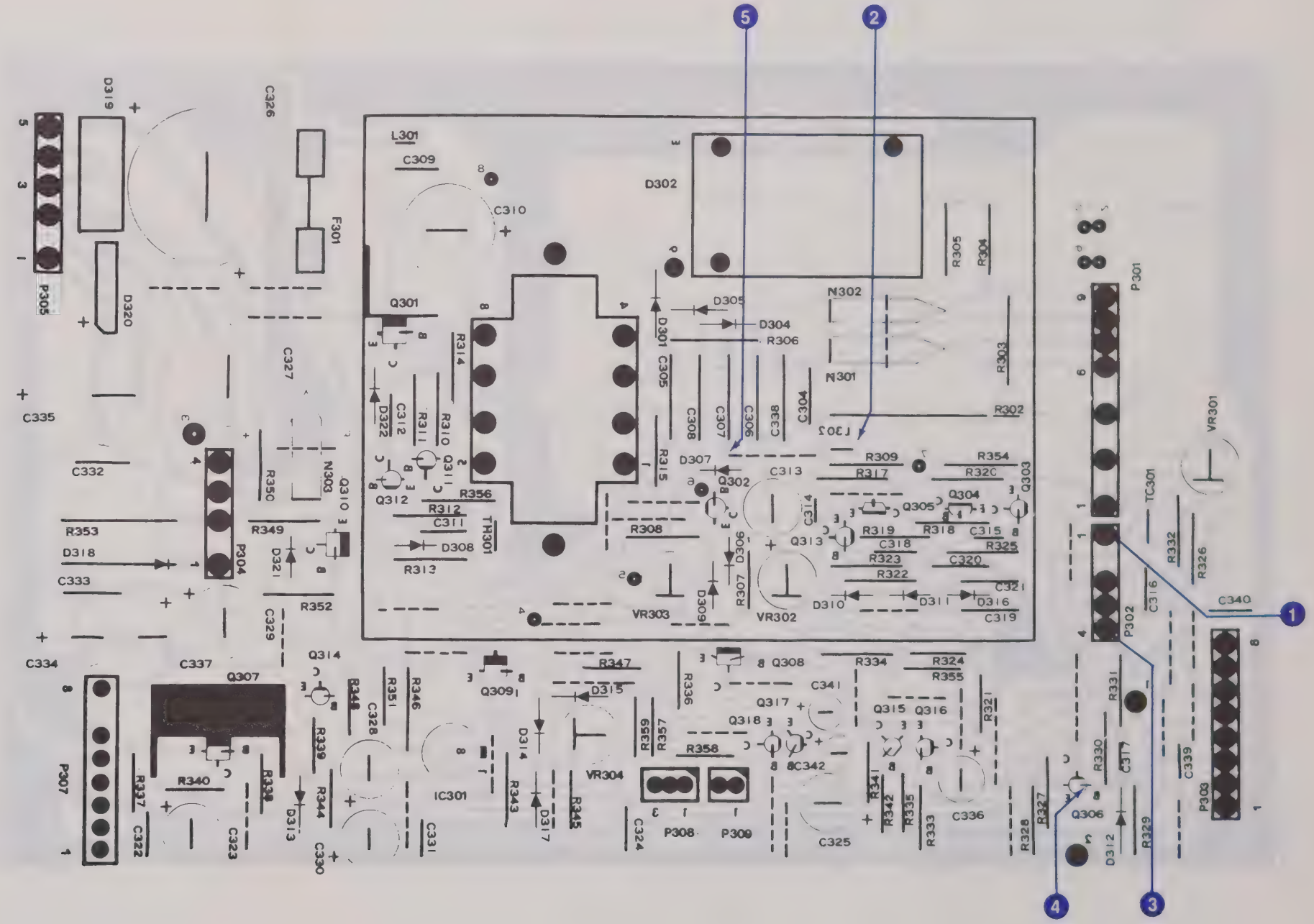


28 Sweep is +.1V dc (logic Low)
X-Y Mode is +4V dc (logic High)

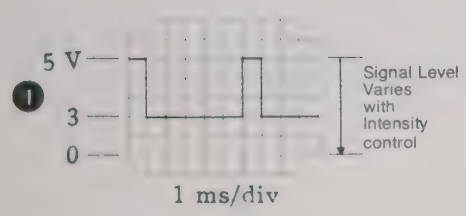

SWEEP
(X74-1211-61)
SCHEMATIC, HORIZONTAL & SWEEP
SOURCE
COUPLING
EXT TRIG
TRIGGERING
NORM/FIX
VIDEO
PULL AUTO
CAL 5Vpp
SWEEP TIME/CM
FRAME
LINE
SLOPE
1.6V + SLOPE
1.6V – SLOPE
2.2V + SLOPE
1.5V – SLOPE
1.3V NORM
1.6V FIX
-3V NORM
-2V FIX
2V NORM
1.7V FIX
1.5V FIX
1.2V NORM
1.2V FIX
-3V SWEEP
1.6V X–Y
-7.5V X–Y
0V SWEEP
-8V X–Y
-8V SWEEP
1.3V X–Y
10.3V SWEEP
15.9VX–Y
0V SWEEP
3.2V X–Y
IC1
IC2
IC3
IC5

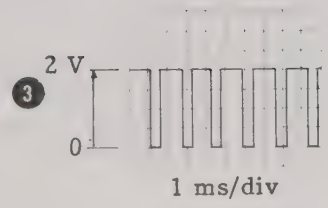
CIRCUIT BOARD MAP, HORIZONTAL & SWEEP

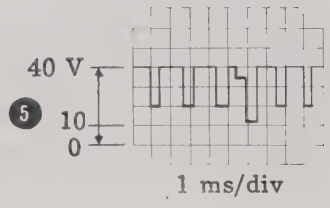


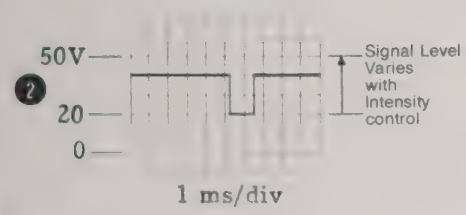

5
2
1
4
3
L301
C309
C310
Q301
D302
D305
D304
R306
D301
C305
N302
N301
R305
R304
R303
R302
C308
C307
C306
C303
C304
F303
D307
Q302
C313
R309
R317
R354
R320
Q303
Q304
Q305
R319
R318
C315
C318
R325
R323
C320
R322
C321
D310
D311
D316
C319
VR302
VR303
D309
R307
R308
R315
C314
Q313
TH301
R312
C311
D308
R356
Q312
Q311
Q310
N303
R350
R349
D321
R352
C329
P304
R353
D318
C333
C332
C335
D319
C326
F301
C327
D320
P305
P301
VR301
TC301
R332
R326
C316
C340
P302
R331
C317
R329
C339
P303
R330
Q306
D312
R327
R328
C336
R333
R335
R341
R342
C325
C342
Q317
Q318
Q315
Q316
R321
R334
R324
R355
Q308
R336
C341
R359
R357
R358
P308
P309
C324
R345
VR304
D315
R347
Q309
D314
R343
D317
IC301
C331
R346
R351
R344
C328
R339
R338
D313
C330
C323
R340
R337
C322
P307
C334
C337
Q307
Q314

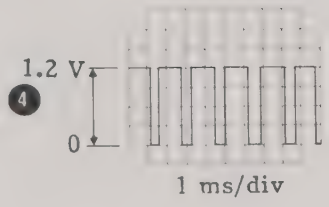
TEST CONDITIONS:
(Scope Under Test)
SWEEP TIME = 0.5 ms/div.
INTENSITY = Normal
Waveform 3 applied at Z-AXIS INPUT; also applied as external trigger.

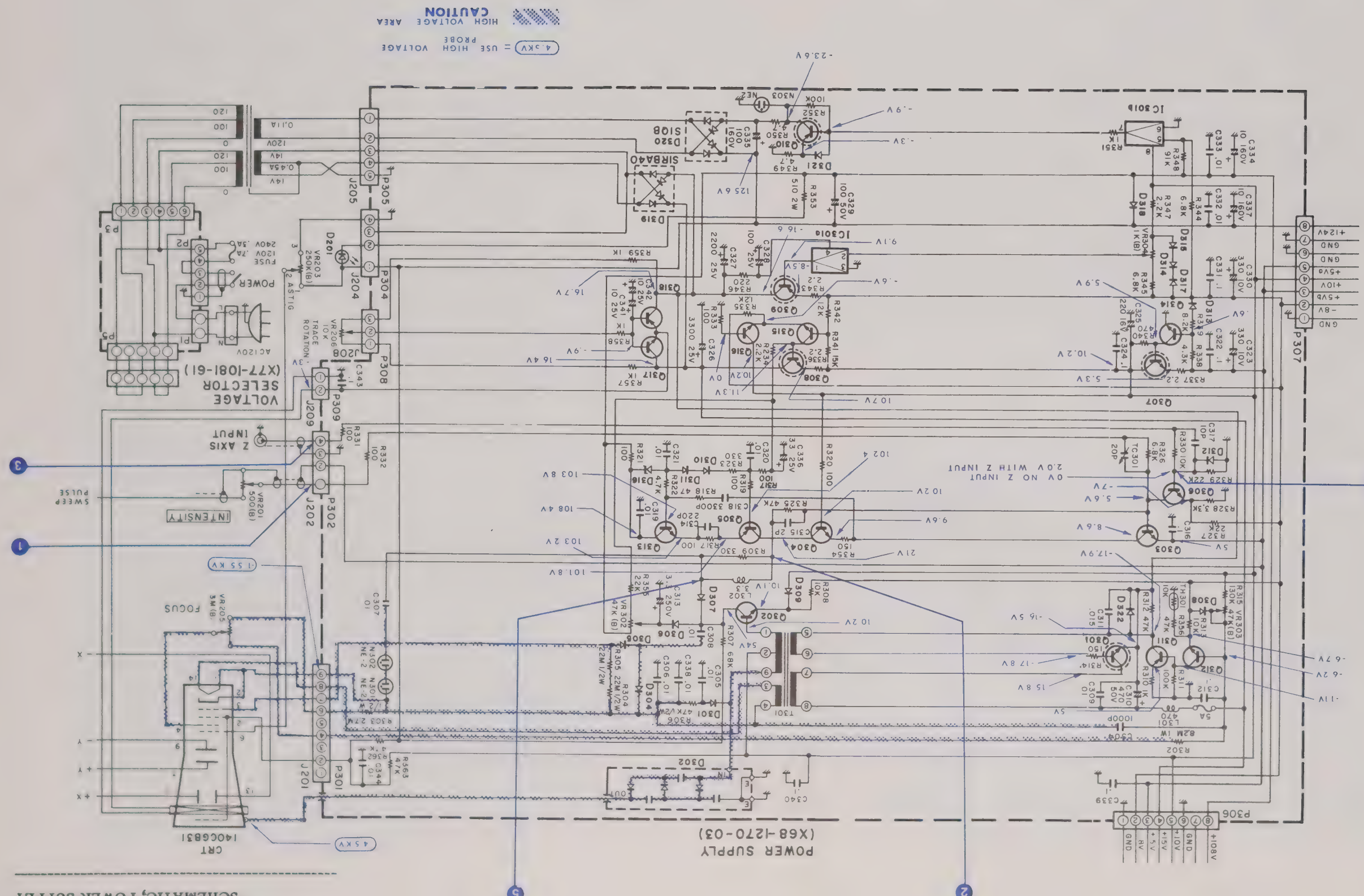






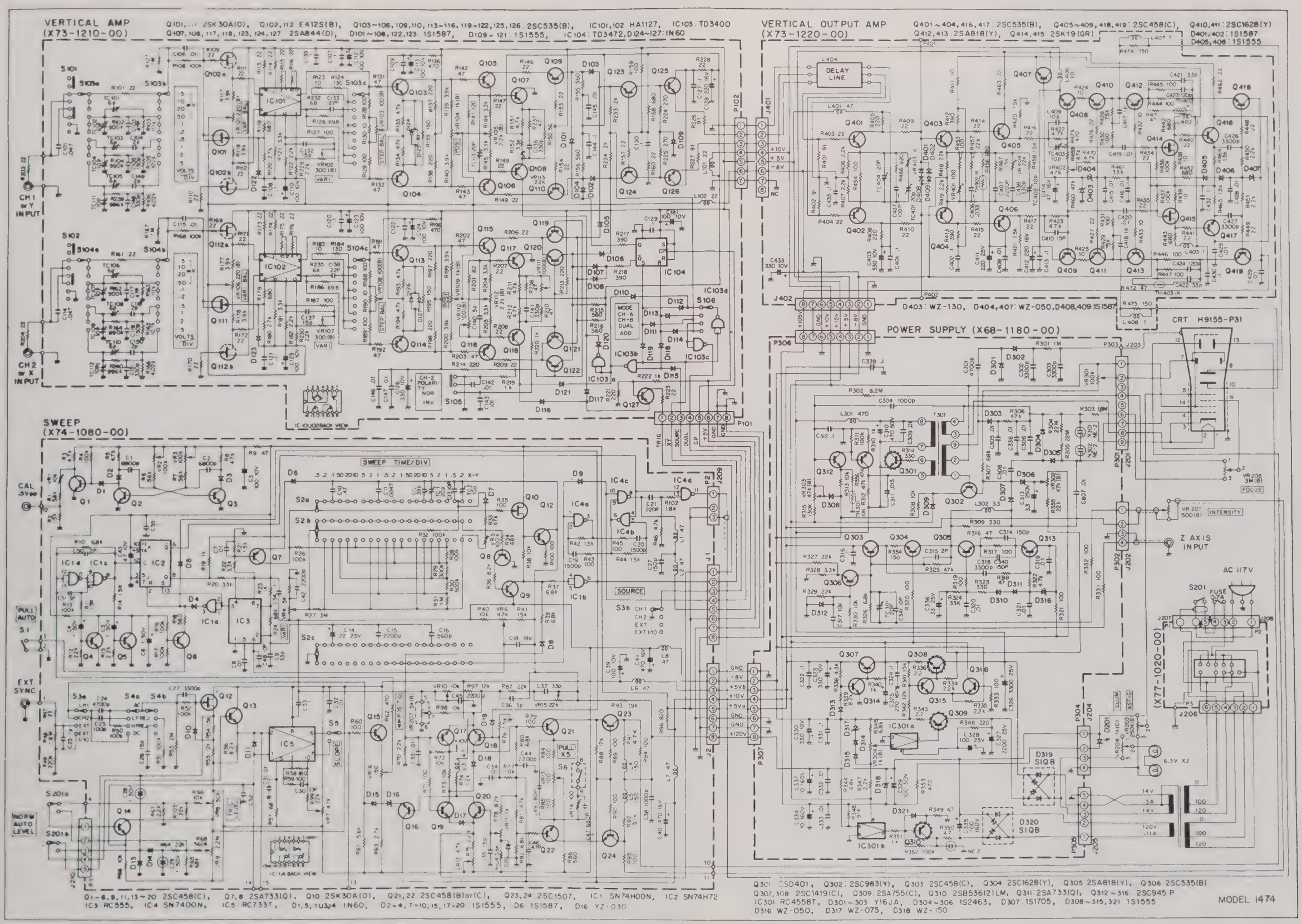






SCHEMATIC, POWER SUPPLY

OVERALL SCHEMATIC, MODEL 1474



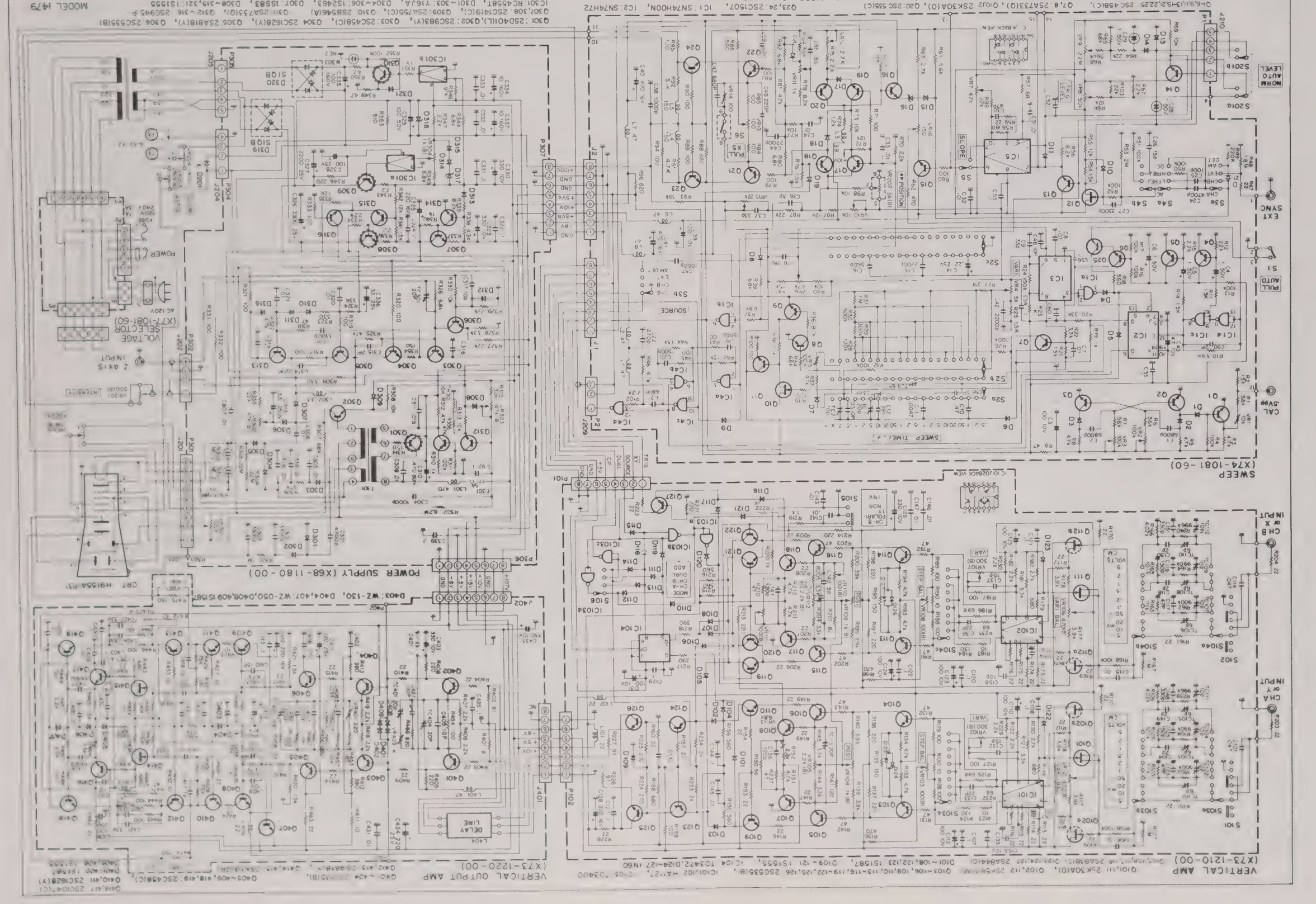
Q1~6,9,11,13~20 2SC458(C), Q7,8 2SA733(Q), Q10 2SK30A(O), Q21,22 2SC458(B)or(C), Q23,24 2SC1507, IC1 SN74H00N, IC2 SN74H72
IC3 RC555, IC4 SN7400N, IC5 RC733T, D1,5,1U3J4 1N60, D2~4,7~10,15,17~20 1S1555, D6 1S1587, D16 YZ-030

Q101,111 2SK30A(O), Q102,112 E412S(B), Q103~106,109,110,113~116,119~122,125,126 2SC535(B), IC101,102 HA1127, IC103 TD3400
Q107,108,117,118,123,124,127 2SA844(D), D101~108,122,123 1S1587, D109~121 1S1555, IC104 TD3472, D124~127 IN60

Q301 2SD401, Q302 2SC983(Y), Q303 2SC458(C), Q304 2SC1628(Y), Q305 2SA818(Y), Q306 2SC535(B)
Q307,308 2SC1419(C), Q309 2SA755(C), Q310 2SB536(2)LM, Q311 2SA733(Q), Q312~316 2SC945 P
IC301 RC4558T, D301~303 Y16JA, D304~306 1S2463, D307 1S1705, D308~315,321 1S1555
D316 WZ-050, D317 WZ-075, D318 WZ-150

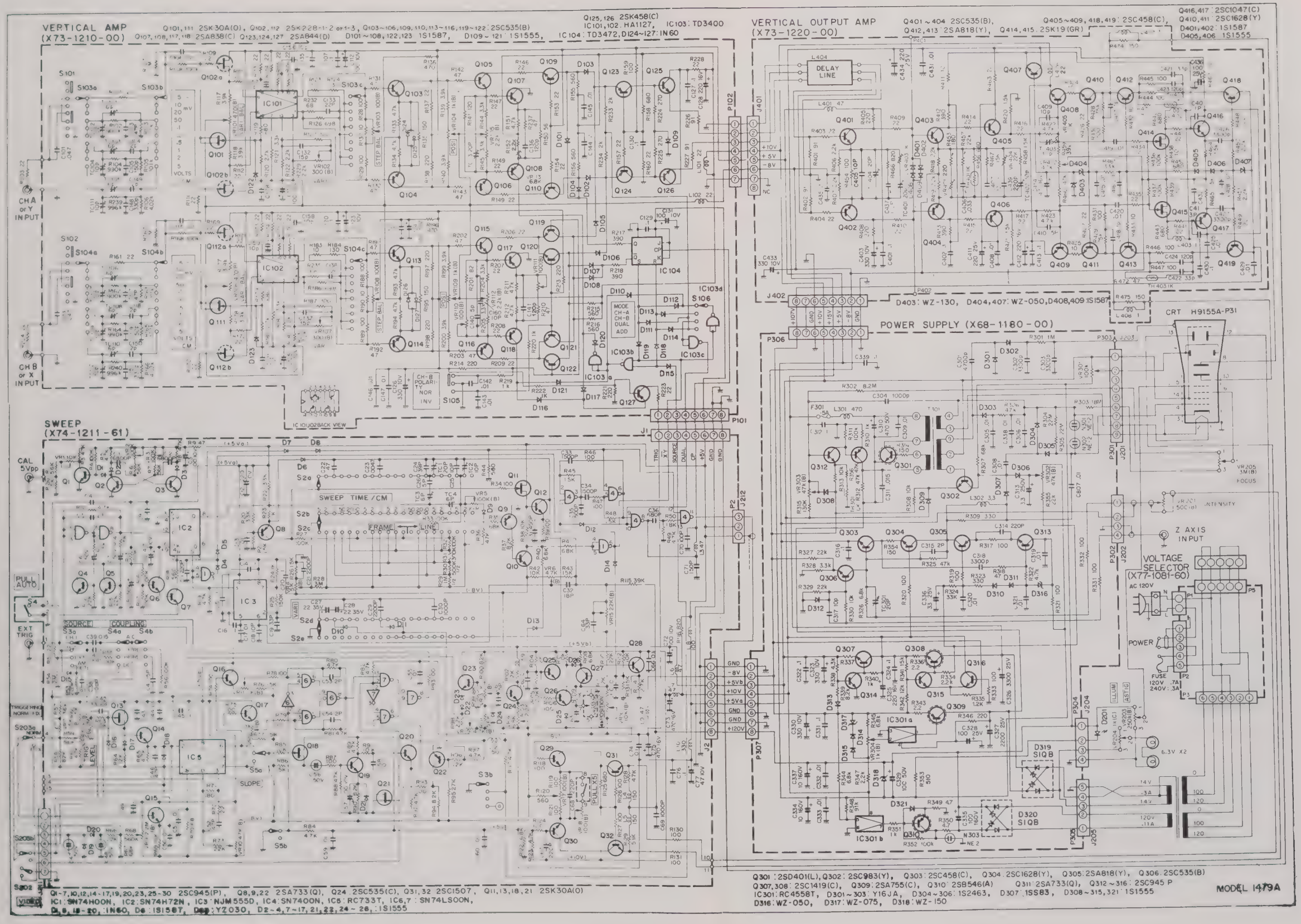
Q401~404,416,417 2SC535(B), Q405~409,418,419 2SC458(C), Q410,411 2SC1628(Y)
Q412,413 2SA818(Y), Q414,415 2SK19(GR) D401,402 1S1587
D405,406 1S1555

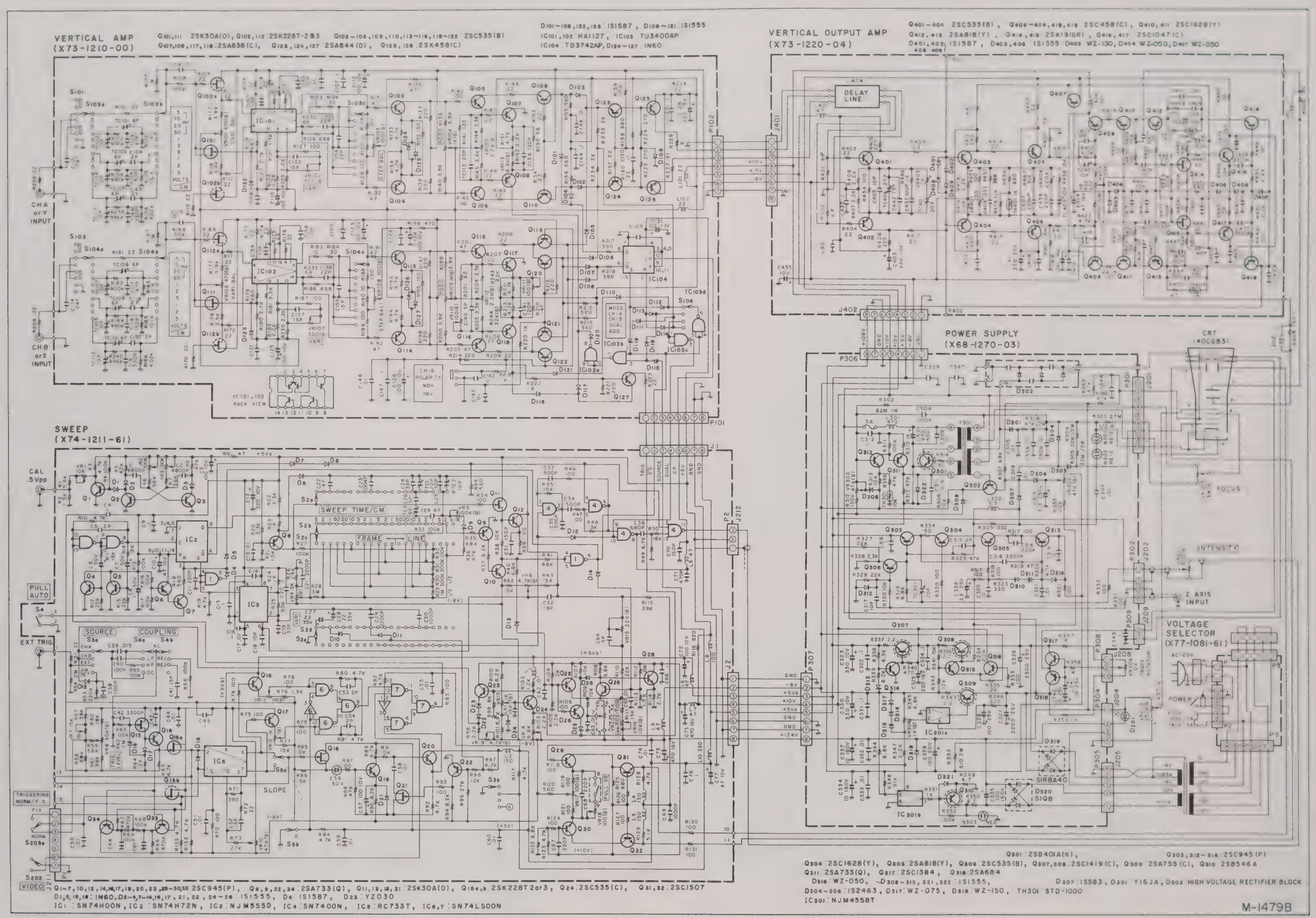
D403 WZ-130, D404,407 WZ-050, D408,409 1S1587



OVERALL SCHEMATIC, MODEL 1479

OVERALL SCHEMATIC, MODEL 1479A




VERTICAL AMP
(X73-1210-00)
Q101,111 2SK30A(O), Q102,112 2SK228T-2&3 Q103~106,109,110,113~116,119~122 2SC535(B)
Q107,108,117,118 2SA838(C), Q123,124,127 2SA844(D), Q125,126 2SK458(C)
D101~108,122,123 1S1587, D109~121 1S1555
IC101,102 HA1127, IC103 TU3400AP
IC104 TD3742AP, D124~127 1N60
VERTICAL OUTPUT AMP
(X73-1220-04)
Q401~404 2SC535(B), Q405~409,418,419 2SC458(C), Q410,411 2SC1628(Y)
Q412,413 2SA818(Y), Q414,415 2SK19(GR), Q416,417 2SC1047(C)
D401,402 1S1587, D403,406 1S1555 D403 WZ-130, D404 WZ-050, D407 WZ-050
D408,409
DELAY LINE
POWER SUPPLY
(X68-1270-03)
CRT
14QGB31
SWEEP
(X74-1211-61)
CAL .5Vpp
PULL AUTO
EXT TRIG
TRIGGERING NORM/F.R
VIDEO
SOURCE
COUPLING
SLOPE
SWEEP TIME/CM
FRAME
LINE
CH-B POLARITY NOR INV
MODE CH-A CH-B DUAL ADD
CHA or Y INPUT
CHB or X INPUT
INTENSITY
Z AXIS INPUT
VOLTAGE SELECTOR
(X77-1081-61)
AC120V
POWER
FOCUS
SIRBA40
Q1~7,10,12,14,16,17,19,20,23,28~30,33 2SC945(P), Q8,9,22,34 2SA733(Q), Q11,13,18,21 2SK30A(O), Q15a,b 2SK228T2or3, Q24 2SC535(C), Q31,32 2SC1507
D1,5,15,16 IN60, D2~4,7~14,17~21,22~24~26 1S1555, D6 1S1587, D23 YZ030
IC1 SN74H00N, IC2 SN74H72N, IC3 NJM555D, IC4 SN7400N, IC5 RC733T, IC6,7 SN74LS00N
Q301 2SD401A(K), Q303,312~316 2SC945(P)
Q304 2SC1628(Y), Q305 2SA818(Y), Q306 2SC535(B), Q307,308 2SC1419(C), Q309 2SA755(C), Q310 2SB546A
Q311 2SA733(Q), Q317 2SC1384, Q318 2SA684
D316 WZ-050, D308~315,321,322 1S1555, D307 1SS83, D301 Y16JA, D302 HIGH VOLTAGE RECTIFIER BLOCK
D304~306 1S2463, D317 WZ-075, D318 WZ-150, TH301 STD-1000
IC301 NJM4558T
M-14798

HISTORY OF PRODUCTION CHANGES

MODEL 1479A

This list itemizes production changes made to Model 1479A. The schematic diagram and parts list reflect the original version. Refer to this list when servicing later versions.

Serial No. 99-07901 and Higher.

R457 changed from 22 KΩ to 39 KΩ.
R466 changed from 820 Ω to 1000 Ω.
R467 changed from 15 KΩ to 22 KΩ.

Serial No. 99-08101 and Higher.

C437 changed from 100 pF to 82 pF.
C71 changed from 150 pF to 470 pF.

Serial No. 99-08201 and Higher.

R241, R242, R243, R244 added.
C407 changed from 2200 pF to 470 pF.
C437 changed from 82 pF to 120 pF.
R457 changed from 39 KΩ to 22 KΩ.
R467 changed from 22 KΩ to 30 KΩ.

Serial No. 99-08401 and Higher.

C437 changed from 120 pF to 82 pF.

Serial No. 99-09001 and Higher

C52 changed from 47 pF to 15 pF.
C64 changed from 33 pF to 5 pF.
C70 changed from 470 pF to 150 pF.
C71 changed from 150 pF to 470 pF.
C78 added.
L1 changed from 3.9 μH to 1 μH.
R71 changed from 180 Ω to 390 Ω.
R111 changed from 12 KΩ to 15 KΩ.

Serial No. 99-09601 and Higher
(Major change to FIX circuit; refer to Model 1479B schematic and parts list for later version)

Q33, Q34 added.
Q15 changed from 2SC945P to 2SK228T.
D19, D20 deleted.
VR9 deleted.
R68, R132, R133 added.
R57 changed from 36 KΩ to 39 KΩ.
R58 changed from 82 KΩ to 68 KΩ.
R60 changed from 10 KΩ to 100 KΩ.
R61 changed from 47 KΩ to 39 KΩ.
R66 changed from 22 KΩ to 470 KΩ.
R67 changed from 68 KΩ to 470 KΩ.
R69 changed from 10 KΩ to 100 KΩ.
C154 changed from 27 pF to 22 pF.

Serial No. 99-09726 and Higher.

R142 changed from 47 Ω to 100 Ω.
R143 changed from 47 Ω to 100 Ω.
R253, R476 added.
C405 changed from 10 pF to 27 pF.

MODEL 1479B

This list reflects production changes made to Model 1479B. The schematic diagram and parts list reflect the latest version. Refer to this list when servicing earlier versions.

Serial No. 99-09901 and Higher

Q15 changed from 2SK228T to 2SK185.
C46 changed from 100 pF to 47 pF.
R70 changed from 68 Ω to 100 Ω.

Serial No. 99-10051 and Higher.

R142 changed from 47 Ω to 100 Ω.
R143 changed from 47 Ω to 100 Ω.
C312 changed from Ceramic to Metal Film.

Serial No. 99-10701 and Higher.

R453 deleted.
Q1 changed from 2SC1811 to 2SC2910S.
Q2 changed from 2SA876-2 to 2SA1208S.
Q302 changed from 2SC983Y to 2SC2229Y.
Q309 changed from 2SA755C to 2SB633E.

continued from inside front cover

9. Some equipment with a two-wire ac power cord, including some with polarized power plugs, is the "hot chassis" type. This includes most recent television receivers and audio equipment. A plastic or wooden cabinet insulates the chassis to protect the customer. When the cabinet is removed for servicing, a serious shock hazard exists if the chassis is touched. Not only does this present a dangerous shock hazard, but damage to test instruments or the equipment under test may result from connecting the ground lead of most test instruments (including this oscilloscope) to a "hot chassis". To make measurements in "hot chassis" equipment, always connect an isolation transformer between the ac outlet and the equipment under test. The **B & K-Precision** Model TR-110 Isolation Transformer, or Model 1653 or 1655 AC Power Supply is suitable for most applications. To be on the safe side, treat all two-wire ac powered equipment as "hot chassis" unless you are sure it has an isolated chassis or an earth ground chassis.

10. Special precautions are required to measure or observe line voltage waveforms with any oscilloscope. Use the following procedure:

    a. Do not connect the ground clip of the probe to either side of the line. The clip is already at earth ground and touching it to the hot side of the line may "weld" or "disintegrate" the probe tip and cause possible injury, plus possible damage to the scope or probe.

    b. Insert probe tip into one side of the line voltage receptacle, then the other. One side of the receptacle should be "hot" and produce the waveform. The other side of the receptacle is the ac return and no waveform should result.

11. Never work alone. Someone should be nearby to render aid if necessary. Training in CPR (cardio-pulmonary resuscitation) first aid is highly recommended.

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